01 Jan 1999

University of Missouri--Rolla Self-Study Prepared for the North Central Association of Colleges and Schools

University of Missouri--Rolla

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Colleges and Schools

1999

PREAMBLE

PATTERNS OF EVIDENCE AND DOCUMENTATION

Early in its deliberations, the steering committee for the 1999 North Central Association accreditation process at the University of Missouri-Rolla (UMR) decided to prepare the institution's study in narrative form. The committee discussed using a criterion-based format but concluded that the existing documentation regarding campus planning could be more easily incorporated into a narrative report such as had been used to prepare the UMR Self Study a decade ago. The process of self-study described by the North Central Accreditation Commission occurs on a biannual basis at the University of Missouri-Rolla. There is a well established, well understood strategic planning process in which several open meetings are convened and to which all members of the institutional community (faculty, staff, and students) are invited. Copies of this year's schedule and letter inviting participation from UMR's chancellor to faculty, staff and students follow this page. The mission and vision of the institution are discussed and the result of the open meetings and subsequent consideration by the administrative leadership team is a detailed strategic plan which sets forth mission, vision, goals and objectives, and detailed action items with assigned responsibilities. A copy of the 1998-99 strategic plan accompanies the self-study. Copies of earlier plans will be made available to the accreditation term during its visit. In addition to the planning document, a results document detailing the achievements of the previous year is also produced on an annual basis. The most recent copy of that document also accompanies the self-study. Again, earlier versions will be available.

The campus also underwent an intense internal and external review during 1994 and 1995. The University of Missouri-Rolla made application for the Missouri Quality Award. This is based upon criteria developed for the national Malcolm Baldridge Award and resulted in the preparation of an application which documents, in some detail, the topics of leadership, information and analysis, strategic and operational planning, human resource development and management, educational and business process management, school performance results, and student and stakeholder satisfaction. In 1995, UMR received the Missouri Quality Award, a first for an institution of higher education in the state. A copy of this document also accompanies the self-study. There were brief discussions between UMR Chancellor Park and North Central Association staff regarding the 1999 UMR self-study being prepared as a Baldridge document but the steering committee decided otherwise.

In 1995-96, the University of Missouri System instituted a formal program review process in which each of the four campuses were required to set academic priorities. UMR, again through an inclusive planning process, produced a program

UPDATED
FY00 Strategic Action Plan Timeline

Open Campus Meeting: Strategic Budget Planning Budget Mission Enhancement Capital Campaign Marketing	9:00-noon	MO Room	February 16
SCHEDULED Chancellor's Staff Group	1:30 - 4:30	216 Parker	February 22
Open Chancellor's Council Meeting UM System Plan Campus priorities Alignment Schedule	8:00-9:00	MO Room	March 2
Memo sent to faculty, staff, and student organizations requesting input for action items			March 3
Open Campus Meeting: Enhanced Academic Excellence Retention/Recruiting Research and Teaching Quality Outreach	2:00-4:00	MO Room	March 31
Deadline for submitting departmental plans to dean or vice chancellor, including action items supported by the departments			April 5
Board of Trustees Review of Mission, Vision, Goals, and Measurements			April 29
SPECIAL Chancellor's Staff Group Meeting	noon-5:00	S&G Room	May 3
Chancellor's Council Report on Unit Plans by the Deans and Vice Chancellors	8:00-9:00	MO Room	May 4
Deans and Vice Chancellors will Present Their Unit Plans to Chancellor			May 7
Open Campus Meeting: Campus FY00 Strategic Action Plan Review	9:00-noon	MO Room	May 12
Chancellor's Staff Group Retreat Finalize Strategic Action Plan			July 19-21
Distribute FY99 Strategic Action Plan			September 1

UNIVERSITY OF MISSOURI-ROLLA

Office of the Chancellor

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TO: UMR Faculty, Staff & Students

FROM: John T. Park
Chancellor

DATE: March 3, 1999

RE: UMR Strategic Action Plan FY00 - Proposed Action Item Request

The specific purpose of this correspondence is to invite you to submit action items* that will result in UMR's FY00 Strategic Action Plan goals being fulfilled, its mission being satisfied, and its vision realized.

UMR's emphasis on its "super goals" involving **recruitment, retention, assessment, grants and contracts, the full-circle campaign, faculty and staff satisfaction**, and **faculty and staff performance** is consistent with the current thrust of the UM Plan. Each department is strongly encouraged to develop action items which address UMR's super goals.

Your suggested action items should be submitted directly to your departmental chair or director. **Each department will forward their departmental plan, which will include the action items supported by the department, to their respective dean or vice chancellor by April 5.**

The Chancellor's Staff Group will meet on May 3rd to review and compile the unit plans for inclusion in UMR's FY00 Strategic Action Plan. UMR's FY00 Strategic Action Plan will be impacted by the UM System Strategic Action Planning process. The Chancellor's Staff Group will work to ensure that UMR's plan is in alignment with the UM Plan.

Thank you for your efforts on behalf of the University of Missouri-Rolla.

*Action Items satisfy four criteria:

1) They clearly relate to the completion of one of the Goals.
2) They are accomplished with existing resources--financial and human resources.
3) They are completed within a year. (Note that major projects may be divided into one-year increments.)
4) They have clearly defined outcomes that can be measured. (It should be clear to an observer that improvements occurred and that the University is better because of the effort.)

review report which was approved by the Board of Curators. A copy accompanies the self-study.

To assist the members of the visiting accreditation team, this Preamble provides a map to information germane to each of the five accreditation criteria. Such information is contained within the self study itself as well in the supporting documents described above.

The self-study process began in March of 1997 when the chancellor asked the vice chancellor for academic affairs to assume responsibility for leading the self-study steering committee. The vice chancellor attended the 1997 annual meeting of the North Central Association and gleaned significant information from representatives from other institutions regarding the self-study process. Shortly after the annual meeting, the vice chancellor for academic affairs met with the chancellor's staff (the campus leadership group consisting of the vice chancellors and deans as well as two assistants to the chancellor) and discussed the self-study process and the need to create a steering committee. The steering committee was appointed by the chancellor upon the advice of the staff group and began its deliberations.

A draft document was prepared by the steering committee using the existing strategic planning documents and Missouri Quality Award application. The steering committee membership is: J. R. Bayless, associate dean, School of Engineering, W. J. Gajda, vice chancellor for academic affairs, R. A. Kohser, associate dean, School of Mines and Metallurgy, M. McKean, technical editor, D. A. Robinson, director, Center for Personal and Professional Development, L. Williams, associate dean, College of Arts and Sciences. Providing administrative support to the committee are: B. J. Cruise, administrative assistant, Academic Affairs, C. M. Heddinghaus, director, Institutional Research and Budget Planning, R. L. Kegebein, senior analyst, Institutional Research and Budget Planning, M. Reynolds, secretary, Technical Editorial Services, and V. M. Ryle, executive staff assistant II, Academic Affairs. Once the draft was prepared, five criteria committees, each consisting of seven members selected from the faculty and administrative staff, were convened. Each commmittee was provided with the relevent criterion information from the North Central Association and the draft document. Each was asked to provide information which would strengthen the case for the satisfaction of the criterion and was missing from the current draft. After the suggestions from the five committees were incorporated into the draft, it was posted on the university's web site and the entire community was invited to provide comment and suggestions for improvement.

In addition, the vice chancellor for academic affairs described the accreditation process at three meetings of the Academic Council to invite comment from the Council and its membership. The vice chancellor also used six monthly meetings of the chancellor's council (a group consisting of academic department heads, support

department heads, deans, vice chancellors, as well as representatives from the Student Council, Graduate Student Council, and Staff Council) to describe the accreditation process and invite participation from all attendees and from those they represent. At two of the Chancellor's Council meetings, the vice chancellor made formal presentations and at four he made announcements inviting participation in the accreditation process.

As a result of this open, inclusive preparation, over 90 members of the university community have provided comments on the self-study. Some individuals provided relatively few comments while others volunteered for extensive editorial duty and contributed significant substantive comment as well.

What follows is a description of the documents germane to the accreditation visit as well as a map, arranged by items of patterns of evidence called out in the *North Central Handbook of Accreditation* which serves to direct interested parties to the locations in the various documents which provide the particular pattern of evidence. The following also serves to provide overall summaries of the evidence indicating that the University of Missouri-Rolla satisfies the five criteria for accreditation.

The abbreviations used below are:

NCSS - the body of the self-study

MQAA - the Missouri Quality Award Application

SAP - the 1998-99 Strategic Action Plan

SAPA - the 1997-98 Strategic Action Plan Accomplishments

PRR - the 1996 Program Review Report

Further, all web addresses are given with the leading character string (http://www) suppressed. Each of the five criteria is examined in turn.

Criterion One

The institution has clear and publicly stated purposes consistent with its mission and appropriate to an institution of higher education.

a) Long and short range educational goals have been developed through open planning processes and are detailed in the following documents

NCSS, pp 7-8, details of mission and vision

SAP, in toto, details of plans for each division

b) Processes, involving its constituencies, through which the institution evaluates its purposes

MQAA, pp 15-22, details of campus planning process

PRR, inside back cover, flow chart of planning

NCSS, pp 8-11, campus planning - major results

c) Decision-making processes that are appropriate to its state mission and purposes

NCSS, pp 21-27, details of University of Missouri System and UMR governance and decision-making processes

d) Understanding of stated purposes by constituencies

NCSS, pp 7-9, pp 11-16, identification of constituencies and interventions
MQA, pp 59-70, stakeholders and their satisfaction

e) Efforts to keep public informed of its institutional and educational goals

Brochures, catalogs and other promotional materials are distributed annually to other four year institutions of higher education, community colleges, and high schools

UMR's Office of Public Relations keeps constituencies informed through news releases to regional and national media

At the URL umr edu, any interested person is able to review news and examine nearly any aspect of UMR's activities

f) Support for freedom of inquiry for faculty and students

UMR's faculty handbook (umr edu/~ac-afrs/fbook contents html) section II A 2 explicitly sets forth freedom of inquiry for faculty

The 1998-99 Student Handbook, pp 30-31, details students' rights and responsibilities including "Freedom to examine and discuss all questions of individual interest, and to express opinions publicly and privately, and the responsibility to express one's beliefs and opinions "

g) Institutional commitment to excellence in faculty teaching and student learning

SAP - pp 31-40, student success
pp 40-42, faculty teaching
NCSS - pp 65-70, academic program
NCSS Appendix B, departmental assessment

Criterion Two

The institution has effectively organized the human, financial, and physical resources necessary to accomplish its purposes.

a) governance by a board consisting of informed people .

NCSS - pp 21-24, Board of Curators and Coordinating Board for Higher Education

b) effective administration through well-defined and understood organizational structure, policies, and procedures

NCSS - pp 23-26, campus administration
URL (system missouri.edu), system governance, rules and regulations
URL (umr edu/~chanc/policy/contents htm), campus policy memoranda
MQAA - pp 1-5, description of campus administration

c) qualified and experienced administrative personnel

Administrative personnel are chosen via inclusive search processes which are normally national in scope Resumes of all administrators are available to the accreditation team

d) systems of governance that provide dependable information to constituencies and, as appropriate, involve them in the decision-making processes

MQAA - pp 15-22

MQAA - pp 7-14

e) faculty with education credentials that testify to appropriate preparation for the courses they teach

ABET & CSAB accreditation for all eligible UMR degree programs is testimony to faculty quality

97% of UMR faculty earned doctoral degrees

f) a sufficient number of students enrolled

NCSS - pp 57-62

Additional detail regarding students is provided by the UMR Fact Book, available to the visiting team members

g) provision of services that afford all admitted students the opportunity to succeed

NCSS - pp 27-36, academic support services

NCSS - pp 37-44, student affairs services

h) a physical plant that supports effective teaching and learning

NCSS - pp 55-56, physical resources

i) conscientious efforts to provide students with a safe and healthy environment

NCSS - pp 47-49, campus services

j) academic resources and equipment

NCSS - pp 27-34, library resources and computing environment

k) a pattern of financial expenditures that shows the commitment to provide both the environment and the human resources necessary for effective teaching and learning

UMR Fact Book provides detailed information regarding revenues and expenditures

l) management of financial resources to maximize the institutions capability to meet its purposes

the planning processes detailed for UMR drive the allocation of financial resources

NCSS - p 8, summary of reallocations to meet campus priorities

Criterion Three

The institution is acomplishing its educational and other purposes.

a) educational programs appropriate to an institution of higher education

NCSS - pp 65-89, core program elements

NCSS - pp 80-83, academic departments and degrees

Graduate and undergraduate catalogs provide degree programs and course descriptions

NCSS - pp 76-78, graduate programs

URL (umr.edu/~ac-afrs/oure.html) details UMR's Opportunities for Undergraduate Research Program

b) assessment of appropriate student academic achievement

NCSS - p 9, summary

NCSS - pp 37-38, basic assessment elements

NCSS Appendix B, detailed departmental assessment programs

NCSS - pp 65-67, outcome assessment

c) control by faculty of evaluation and student learning and granting of academic credit

While the registrar maintains academic records, faculty have sole responsibility for the granting of academic grades and credit

d) graduate programs

NCSS - pp 76-78

Graduate catalog

NCSS Appendix B, departmental assessment

NCSS - p 24-25, graduate program governance

URL umr.edu/~gradchar/ provides information on the graduate faculty and the graduate council

e) transcripts

NCSS - p 36, Office of the Registrar is responsible for all academic records which are maintained to University of Missouri standards and practices

f) effective teaching

NCSS - p 79, faculty performance measures

g) support for professional development

NCSS - pp 51-53, faculty development

NCSS - p 8, $350,000 in recurring funds are allocated to faculty, staff and administrators for professional development

h) student services that support the institution's purposes

NCSS - pp 21, academic affairs

NCSS - pp 37-44, student affairs

NCSS - pp 47-49, campus services

i) staff and faculty services

NCSS - pp 87-89, community enrichment

j) commitment to basic and applied research

NCSS - p 14, research community

NCSS - pp 51-52, basic support

NCSS - pp 83-85, centers and institutes

PRR, in toto, scholarly priorities

k) evidence of effective delivery of educational and other services to its community

NCSS - pp 14-16, outreach and impact

NCSS - pp 86-87, cooperative extension

Criterion Four

The institution can continue to accomplish its purposes and strengthen its educational effectiveness.

a) a current resource base that positions the institution for the future

UMR Fact Book, data on human, financial and physical resources

NCSS - p 63, endowment fund

NCSS Appendix A, UMR is financially healthy

b) decision-making processes with total capability

SAP - pp 1-2, demonstration of ability to set priorities

MQAA - pp 15-22, planning and decision-making processes

NCSS - pp 8-11, campus planning and results

c) structured assessment processes

NCSS - pp 37-38, academic assessment

NCSS Appendix B, departmental assessment processes

d) plans and planning processes necessary for the institution's continuance

MQAA - pp 15-22

NCSS - pp 8-11

Preamble, ii-iii

e) resources organized and allocated to support plans for strengthening the institution and its programs

NCSS - p 8, recent reallocations to fund priorities

NCSS, p 52, mission enhancement resource allocations

Criterion Five

The institution demonstrates integrity in its practices and relationships.

a) student, faculty and staff handbooks

Student Handbooks, provided with self study

Student Academic Regulations, provided with self study

Faculty Handbook, no longer printed, maintained on-line at umr edu /~ac-afrs/fbook contents html

Staff Handbook, provided with self study

b) policies and practices for the resolution of internal disputes within the institution's constituency

These are detailed in the four handbooks mentioned in a) above

c) policies and practices consistent with its mission related to equity of treatment

UMR Affirmative Action Plan, copy available

NCSS - p 4, recruitment of women and minorities

NCSS - pp 35-36, recruitment of minority students

NCSS - pp 40-41, Multicultural Educational Support Program

NCSS - p 44, Minority Engineering Program

d) accurate institutional publications and statements

As a public institution, all of UMR's activities are open to public scrutiny This includes budget details and the salaries of individuals The governance structure and the institutional openness insures accurate publications and statements.

e) relationships with other institutions of higher education are conducted ethically and responsibly

UMR has formal transition and articulation agreements with a number of other institutions

UMR hosts an annual transfer and articulation meeting for representatives of all such institutions to ensure adequate communication and maintenance of the agreements

UMR cooperates formally with other institutions within Missouri through meetings of peers. For example, there are regular meetings of the chief executive officers, chief academic officers, chief student officers, and registrars. These meetings ensure good communication and cooperation

UMR is a member of, and participant in, a large number of national organizations of higher education. A list is available.

d) policies and procedures for intercollegiate athletics, student associations and subsidiary or related business enterprises

NCSS - pp 39-40, athletics, UMR participates in, and complies with NCAA Division II

NCSS - pp 41-42, student activities

e) monitoring of contractual relationships with government, industry and other organizations

URL (system missouri edu 80/legal/), the primary authority rests with the General Counsel of the University of Missouri System, who is responsible for reviewing all contractual relationships prior to acceptance by the University

NCSS - p 47, Externally Sponsored Programs

CONTENTS

PREFACE

This document has been developed as a part of the planning processes ongoing within the University of Missouri-Rolla (UMR) community and the University of Missouri (UM) System. In 1993, the four-campus UM System conducted a significant planning effort under the aegis of the University's Board of Curators focusing on program review, which involved a detailed setting of academic priorities. Within the past two years, the four-campus system has, based on inclusive planning, established priorities for additional support from the State of Missouri under a "mission enhancement" effort. Further, the UMR campus has a well-developed annual planning cycle which produces a detailed strategic plan. UMR has also conducted detailed self-studies via a Baldrige-type process in completing two applications for the Missouri Quality Award and was the first doctoral university in the nation to earn a state-wide quality award. Elements of the above documents were included in the initial draft of this self-study and the resulting document was posted at the campus web site where it was reviewed by all interested members of the community. Sufficient time was provided to solicit additions, modifications, and other improvements.

When John T. Park was named UMR's Interim Chancellor in 1991, the campus began an in-depth study to prepare a five-year budget plan. From this successful process emerged the campus planning initiatives discussed in the preceding paragraph. Thus, self-study and self-analysis are ongoing undertakings and the 1999 North Central Accreditation Review was seen as an opportunity to synthesize these analyses. Accordingly, the steering committee established to oversee the self-study organized subcommittees to address various facets of the NCA criteria for accreditation. The document presented here is the result of the subcommittees' reviews, several drafts edited by the steering committee, and a final review by a broad group of faculty, staff, and students.

In the past, each of these exercises in analysis and planning has found varied audiences. The self-study is anticipated to be a timely means of identifying UMR as a quality component in Missouri's outstanding university system.

The self-study documents that UMR has clear and publicly stated goals consistent with its mission and appropriate to an institution of higher education; that it has effectively organized the human, physical, and financial resources necessary to accomplish its purposes; that its educational and other purposes are being accomplished; that it can continue to accomplish its purposes and strengthen its educational effectiveness; and that it demonstrates integrity in its practices and relationships.

RESPONSES TO THE 1988 REPORT

The report of the NCA evaluation team who visited the campus in January 1989 was comprehensive and very helpful The team raised several concerns as a part of their evaluation and also reflected on a number of points that they expected to become issues in the future

The concerns of the team were echoes of past visits — the quality of graduate students, the state of library resources, faculty compensation, and recruiting of minority and women students and faculty members.

Potential concerns included the low level of faculty compensation and the demographic likelihood of fewer students enrolling in engineering curricula nationally. Also of potential concern was the possibility of an increasingly entrepreneurial faculty encountering issues of conflict of interest.

The percentage of specially admitted graduate students in the FS '98 was 9%, a significant reduction from the 15% of 1988, achieved in part by eliminating the policy of admitting some students as "post-baccalaureate". Off campus, however, the percentage of special students is higher, although their actual numbers are low, due in part to several cooperative and extension programs undertaken by UMR and described later. The number of on-campus special graduate students is expected to continue to diminish; the percentage of special graduate students off campus is expected to remain constant, although the number will probably increase as off-campus programs grow

In the past year, the UMR library has undergone its greatest change since moving into its own building in 1968 The building (which also houses public radio station KUMR, the Video Communications Center, the campus archives, and the UMR office of the Western Historical Manuscript Collection) was thoroughly renovated with new shelving, lighting, heating, and air conditioning, and a significant augmentation in electronic access to both local and remote materials

Although the library continues to struggle with acquisitions, with journal subscriptions, and with staffing, the emphasis has changed to the efficient accessing of information rather than the possession of it. Interlibrary loan activity — both borrowing and lending — continues to grow as a major library enterprise

The greatest change in the library, however, is the use of electronics, computers, and multi-media facilities to access and utilize information. Between 1992 and 1998, the library and the campus expended almost $2 million on networking, database access, and hardware purchase and installation Between 1992 and 1997, the University of Missouri System contributed over $4 million toward meeting the goal of providing access to computerized library information whenever and wherever it is needed. This contribution included purchase of a new state-of-the-art integrated library system, licensing of citation and fulltext databases, and hardware upgrades.

In 1997, the three largest research institutions in Missouri, the Univers. y of Missouri, St Louis University, and Washington University, forged a consortial agreement to share more easily their library resources In 1998, the Missouri State Legislature approved a $3 5 million appropriation for Year 1 of a three-year $10 2 million undertaking to expand that consortial agreement to include 51 higher education institutions throughout Missouri This arrangement, coupled with the addition of a wide array of electronic resources, provides far greater access to information than has ever been available in the past

Student assessment, which in 1988 was relatively new as a campus concern, has evolved into a widely accepted institution providing valuable information — albeit still awaiting " nbridled excitement"

Enrollment continues to be a concern, and recruitment and retention are topics of intense analysis and improvement As detailed elsewhere herein, efforts are in place to strengthen both areas.

Modest progress is evident in recruitment of women and underrepresented minorities as undergraduates. In 1998, 25% of on-campus undergraduate students were women, compared with 21% in 1988 Enrollment of underrepresented (American Indian/Alaskan Native, Black, Hispanic) on-campus undergraduate students also rose slightly in the same period — from 4 3% in 1987 to 5 2% in 1998

Improvement in recruiting women and underrepresented graduate students is also elusive In 1998, of the 640 on-campus graduate students, 21 or 2 8% were minorities (Blacks, American Indians/Alaskan Natives, and Hispanics) and 127 or 20% were women While these are improvements over the 1988 levels, they reflect the reality that we are not recruiting women and minorities at the level we would like

One of our successes, the UMR Minority Engineering Program, has enabled UMR to exceed national averages in retention of minority and women students A new Multicultural Educational Support Program has acquired a building with a computer center and study areas

UMR is also making progress in recruiting minority and women faculty In 1998, of 290 full-time tenured and tenure-track faculty members, 23 (8%) were women, 9 (3 1%) were underrepresented minorities These numbers are slight increases from those for 1988 and are the result of concerted effort However, it has been difficult to retain women faculty.

Faculty compensation has improved substantially since the 1995 five-year budget plan was put into effect. Faculty salaries are now considered to be competitive in the arena in which UMR operates

INSTITUTIONAL OVERVIEW

A Brief History of UMR

The University of Missouri School of Mines and Metallurgy (MSM), which in 1964 became the University of Missouri-Rolla, was founded in 1870 — the first technological institution west of the Mississippi and one of the first in the nation. A product of the Morrill Act of 1862 and the land-grant movement of the late nineteenth century, MSM was Missouri's response to the acute need for scientific and technical education in the burgeoning United States.

In inaugurating the School, President of the University of Missouri Daniel Read stated its purpose:

> *"This school is to be a school both of science and of its applications: its purpose is to teach knowledge and art — first to know and then to do, and to do in the best manner."*

Early curricula were focused on the mining industry and its immediate technological needs, but by the 1920's courses of study included mining, civil, mechanical, electrical, and chemical engineering and chemistry, metallurgy, mathematics, physics, and geology

The School expanded slowly in its first 50 years The building of the campus reflected the steady growth of enrollment — there were 107 students enrolled in 1874, when the first graduating class of three received their diplomas, total enrollment in 1920 was 393, with 59 diplomas awarded (57 B.S degrees, 2 M.S.). Over the years, MSM graduates earned a reputation as competent practitioners, well-trained professionals who do their homework; and the School became a major source of technological talent.

By the time of World War II, enrollment was consistently above 500, and an increased focus on research was reflected in the rising number of graduate degrees: in 1940, 153 B.S. degrees and six M.S.

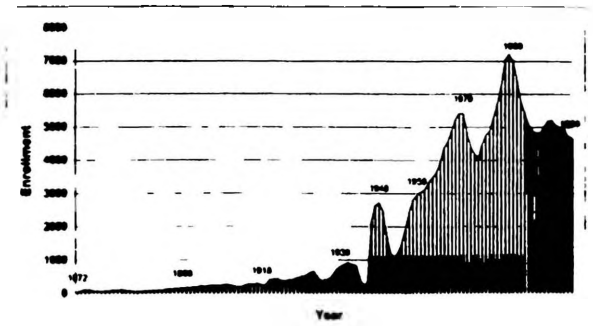


Figure 1.

Graduate education and research began to assume a greater role on the campus in the 1950's, as the nation emerged from World War II as the economic and scientific leader of the free world. Missouri saw the need to strengthen its infrastructure, and the School of Mines and Metallurgy became increasingly a technological university whose impact reached beyond the state and nation.

In 1964, recognizing its expanded nature and role, the name of the institution was changed to the University of Missouri at Rolla, soon to be altered to University of Missouri-Rolla. UMR, as it quickly came to be called, was one of four campuses of the newly reorganized University of Missouri.

The change from "school" to "university" involved four major changes in the programs of the campus. First, UMR's curricula expanded to encompass the full range of engineering and scientific subjects. Degree programs in nuclear engineering, life sciences, and computer science were offered Second, degrees in the humanities and social sciences were established, and the number and quality of faculty and courses grew appropriately. Third, graduate programs strengthened the science and engineering disciplines. Fourth, the commitment to research in all disciplines better enabled the campus to respond to Missouri's needs. Originally a mining school and later an engineering school, the University of Missouri-Rolla had become a major technological university

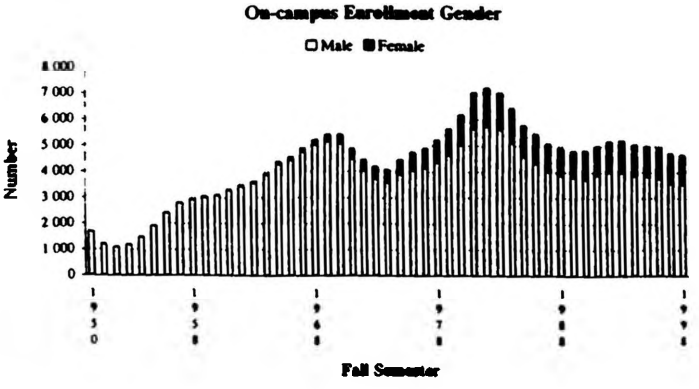


Figure 2.

In the course of these metamorphoses the campus has been transformed from that of a rustic academy to a modern institution of science and engineering. To the well-designed and well-built older campus have been added, beginning in the 1960's, a number of new classroom and laboratory buildings and a new library.

UMR's students today, though predominantly from Missouri, come from all the states of the nation and many foreign countries MSM/UMR's nearly 50,000 alumni can be found in every state of the union and more than 75 countries of the world. The impact of the campus reaches around the globe.

The University of Missouri, including the then School of Mines and Metallurgy, was first accredited by the North Central Association in 1913. The engineering curricula of MSM were accredited in 1936 by the Engineer's Council for Professional Development (ECPD). In 1972, the NCA granted accreditation to the University of Missouri-Rolla as an "operationally separate" campus of the University offering doctoral degree-level programs UMR was accredited in 1978, following an NCA visit that paid particular attention to the graduate programs, and accredited again in 1988 In addition, all UMR engineering programs are accredited by ABET (Accreditation Board for Engineering and Technology), and the computer science program is accredited by the CSAB (Computer Science Accreditation Board)

The University has a long and distinguished record as a land grant institution, fulfilling its responsibilities in teaching, research, service, and extension. The mission of the University was formally affirmed by the Board of Curators on March 20, 1992 The UMR mission statement follows.

University of Missouri-Rolla Mission Statement

The University of Missouri-Rolla, (UMR) has a major responsibility for meeting Missouri's needs for engineering education UMR offers residential programs that include a full range of engineering and science degrees and complementary liberal arts degrees and programs

UMR conducts research to advance knowledge, to provide essential support for graduate education, and to enhance undergraduate education There is special emphasis on research in materials science and engineering, manufacturing, geotechnical engineering, and environmental science and technology

UMR assists in the economic development of the state and nation with the transfer of technology developed through its research programs UMR meets the engineering and scientific educational needs of Missouri's nontraditional students through cooperative efforts with other campuses, innovative delivery systems and specialized extension programs

VISION

In its efforts to educate tomorrow's leaders in engineering and science, the campus community has developed the following vision elements as a product of its planning.

Vision· A university that is a premier source of future leaders in engineering and science able to

- identify and solve technical and societal problems,
- create, synthesize, and communicate knowledge,
- work effectively as team members in diverse environments, and
- adapt to change through life-long learning

Vision A university where faculty, staff and students conduct nationally competitive research to meet societal needs

Vision A university which is recognized as a premier source of readily available knowledge, creativity, and education and whose faculty, staff, and students serve the needs of the society of which it is a part

Vision A university whose faculty and staff are committed to excellence in teaching and learning and to the success of students

Vision A university committed to providing an environment which fosters the development of all members of the university community toward their full potential.

The students, faculty, and university administration, as well as the citizens of the State of Missouri, understand and accept the mission of the University of Missouri-Rolla. Through its history, the campus has focused its activities on science and engineering and on the liberal arts programs that complement the engineering and science offerings As a result, there is a clear understanding of UMR's

mission New initiatives are measured against that mission There is little temptation to divert resources away from the central goals of the institution Missouri's Coordinating Board for Higher Education clearly understands and accepts the role and mission of the University of Missouri-Rolla in meeting the needs of the state

Campus Planning

Efficient implementation of change occurs when 1) a clear mission and vision are understood by all involved, 2) all concerned have input into the process, 3) priorities have been established, and 4) resources have been identified

Campus planning includes long-range planning, which addresses goals and objectives, strategic planning, which addresses the business of the campus, opportunities and hindrances of the external environment, and strengths and weaknesses of the institution as a mode for developing and managing an operating plan, and operational planning, which addresses such issues as space, recruiting and retention, budgetary matters, curriculum matters, and administrative structure This self-study and the findings and recommendations of the North Central Association will provide important additional information which will be incorporated into the ongoing planning process Issues identified will be discussed by appropriate committees, prioritized by the campus, and resolved as quickly as possible

The ongoing program of planning and self-evaluation is realized primarily through an annual planning process This has been augmented by the recent UM system program review to set academic priorities and the subsequent mission enhancement planning which is leading to additional state funding and a refining of campus priorities in scholarship, teaching, and outreach

In accord with the general goals of both the UM System and UMR long range plans the campus has, within the last several years, made major changes, many of which involved significant reallocation and/or changes in campus culture These are indicative, we believe, of a dynamic institution responding to external as well as internal challenges

a) Targeted reallocations of recurring funds over the past several years include $4 3 million for faculty and staff salaries, $400,000 to development, $350,000 in education and training funds used at the discretion of the vice chancellors and deans, $100,000 for a UMR Writing Center to implement a program in writing across the curriculum, and $150,000 to meet campus responsibilities in handling and disposing of chemicals

b) The Environmental Management Services department has begun working on Phase I of the ISO 14000 implementation at UMR The staff have been focusing their efforts on identifying all the environmental legal requirements pertinent to university activities and on identifying the activities at the university that pose the most significant environmental risks

Once these two activities are complete they will be able to establish goals and objectives designed to minimize the legal and exposure risks to the campus At this time they will also be able to recommend an environmental policy for the campus consistent with the goals and objectives identified To the best of our knowledge UMR is the first university which has begun to implement ISO 14000

c) The continuing education division fulfills some of the extension functions so important to a land-grant university Continuing education manages much of the off-campus instruction conducted by UMR — courses such as grounding and shielding, mine ventilation, electromagnetic compatibility, programmable logic controllers, asphalt and concrete conferences, and geotechnical advances symposia In addition, the departments of chemistry and engineering management administer their own programs Chemistry operates the UMR Coatings Institute, which offers courses on paints and coatings Engineering Management offers the annual symposium on Smart Engineering System Design

d) The University of Missouri system created the position of Assistant to the President for Federal Relations This has led to some increases in federal funding for UM

e) In response to concerns expressed by the Governor and the Board of Curators, UMR began in 1987 a formal program of student assessment designed to gauge the competency and development of all undergraduate students Content, academic, and non-academic skills are assessed with a variety of measures, and the program substantially informs academic advising and curriculum development A position, Director for Academic Assessment/Student Research, was created through reallocation of existing resources and some additional new resources. This program has continued to gain faculty and student acceptance over the past eleven years although there still remains more to be done in embedding outcomes assessment in the campus culture

Most academic departments have recognized that assessment beyond assignment of grades is important in understanding how and what students are learning They also increasingly recognize that program improvements flow from results of assessment efforts and are making significant headway in documenting these change processes Students generally are very cooperative with assessment efforts, in contrast to common reactions a decade ago Vastly increased efforts have been made to provide assessment data to the campus, including students, in a timely manner

f) The title of Vice Chancellor for Student Affairs has been changed to Vice

Chancellor for Student and International Affairs This change explicitly recognizes the shift of responsibilities which occurred when the position of Associate Vice Chancellor for Academic Affairs/Extension was dissolved as part of the five-year budget plan developed in 1992. It also clearly demonstrates the importance of international issues to the campus

g) To better fulfill the campus commitment to transfer new technology to Missouri industry, UMR in 1987 organized the Center for Technology Transfer and Economic Development. The Center assists those in Missouri who need technological information. It will foster economic development, and spearhead an effort in manufacturing that will combine the strengths of UMR's eminent programs in materials science and intelligent systems into a facility in which innovations in manufacturing and automation can be developed and demonstrated. The Center was created by reorganization and reallocation of existing campus resources and with new resources. Further, the State of Missouri Department of Economic Development funds UMR's Manufacturing Research and Training Center, which offers Missouri manufacturers opportunities for cooperative research for new and developing technologies.

h) Long-standing needs in maintenance and repair have been addressed by an allocation of $2 1 million in recurring accounts

i) Incentives for faculty to seek external funding have been provided through two avenues 1) a sponsored research incentive fund which returns a portion of the total campus indirect recovery to academic units and faculty in proportion to their contribution to indirect and 2) an equipment matching fund administered by the Vice Chancellor for Academic Affairs which provides equipment matching funds to augment the budgets of sponsored research proposals

j) In response to the need for controlling the growth of costs associated with providing quality higher education, the University of Missouri-Rolla has implemented an Activity Based Costing (ABC) Program The program is shaping administrative services, and its tools assist in the development of the university's strategic and operational plans. The program uses a process that puts information regarding activity measures and costs together to produce valuable performance measures that plot the progression of improvement actions. Core activities were identified and a process flow chart was created to highlight all the individual tasks that were contained in every core activity Although the ABC Program is in its relatively early stages, several significant savings have been achieved in the past two years. Workers compensation,

procurement card purchases and energy management activities are just some examples of areas that are expected to generate several thousands of dollars of annual cost savings as a result of implementing the ABC Program.

k) In an effort to inculcate environmental awareness into its activities, a mandatory one-hour course in Laboratory Safety and Hazardous Materials has been added to the curriculum, and campus chemical inventory has been decreased by over 50%

l) UMR's fraternities and sororities, as well as 80% of its residence hall rooms, have been connected to the campus network with high bandwidth optical fiber

m) The office of the Dean of the Graduate School was dissolved as part of the five-year, 1992-97, budget plan which also led to significant increases in the compensation of faculty and staff

Further, the responsibilities for the graduate program were distributed to the deans, who are in the best position to use graduate progress as part of the reward structure for faculty. These administrative changes have integrated graduate activities into the cores of the academic divisions

n) The 1993 system-wide program review resulted in six areas of priority for research and scholarly emphasis (manufacturing, infrastructure, materials, environment, geotechnical engineering and science, as well as instructional technology) at UMR The significant increase in state funding under the mission enhancement efforts led by the CBHE has been focused almost entirely upon these six areas.

Successful implementation of these major items and reallocations demonstrates that the campus can effect organizational changes in a consensual way

The well-established and well-accepted Mission of the University of Missouri-Rolla provides the campus with an understood, shared set of goals As a result, changes in the campus plan are directed toward the method of achieving those goals in fulfilling the campus mission

At present, the campus is in its first capital campaign — a seven-year, 60 million dollar Full Circle Campaign Gifts are ahead of the schedule projected when the campaign was begun The case study statement for this campaign is another manifestation of the planning process

UMR Clientele

UMR identifies several different client groups These include students who are citizens of Missouri, qualified students from elsewhere, employers, the research community and other users of research, students who are unable to leave the area of their residence, and recipients of direct extension or other service from UMR (citizens, businesses, organizations, and governmental agencies)

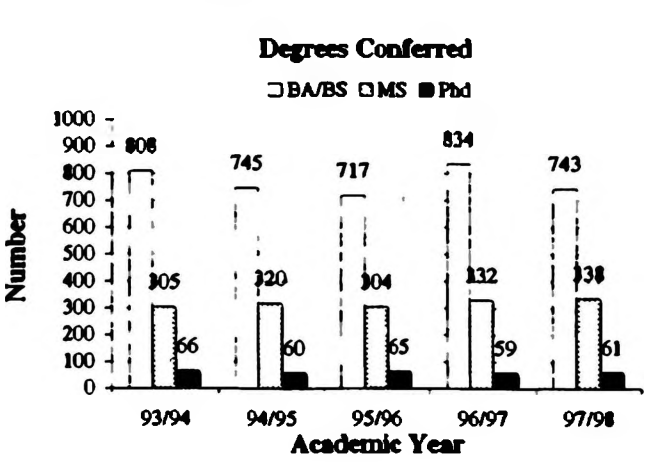
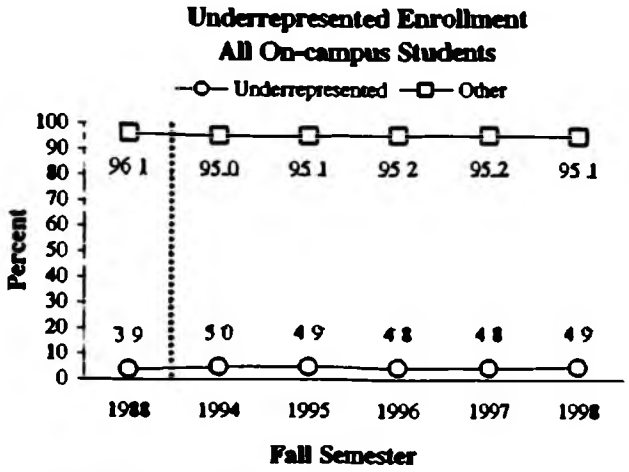


Figure 3

Students Some of the highlights of the on-campus enrollment statistics are as follows Engineering majors constitute 74% of students with Arts and Sciences contributing the remaining 26% of the on-campus student body of 4,673 UMR is among the top 25 universities in the United States in the annual number of undergraduate engineering graduates. The three top programs in terms of the total of undergraduate and graduate degrees granted are Engineering Management, Mechanical Engineering, and Civil Engineering, which together awarded 44% of all degrees granted for 1997-98

Two notable campus records were attained in the 1997-98 academic year. Both the percentage of women (24%) and the percentage of students from outside the state of Missouri (32%) were the highest in the history of the campus. In the fall of 1998, the average age of UMR students was 23 years. Of freshmen undergraduates, 93% are 20 and younger Approximately 90% of on-campus students are unmarried Minority students make up 7 7% of the on-campus student body



Underrepresented = African American, Hispanic, and American Indian/Alaskan Native

Figure 4.

The quality of UMR students is very high and has improved over the past decade. Fifty-one percent (compared to 42% a decade ago) of first-time entering undergraduates are in the top 10% of their high school class. The average reported ACT score of first-time entering students is 28.0, in contrast to a Missouri average of 21.5. This is the highest of any public institution in the state.

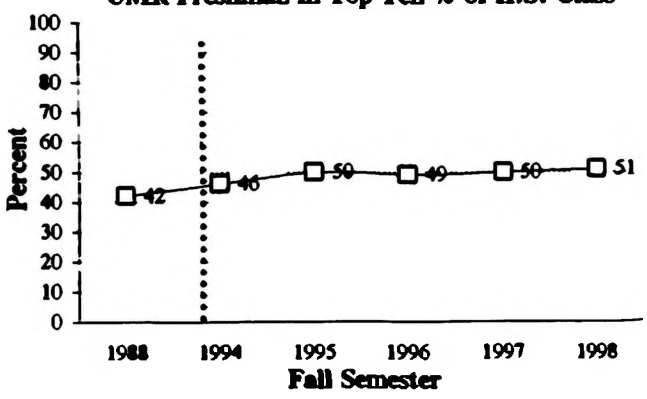


Figure 5

Of all undergraduates, 71% are from Missouri St. Louis and its adjacent counties contribute the most Missouri students, with 27% of all undergraduates coming from that

area Out-of-state students comprise 26% of undergraduate enrollment with Illinois being the largest contributor at 9% International students make up 3% of undergraduate enrollment These numbers indicate that a significant diversification of UMR's undergraduate student body has occurred over the last decade For example, in 1987, 84% of undergraduates were from Missouri with 41% from St Louis and the adjacent counties

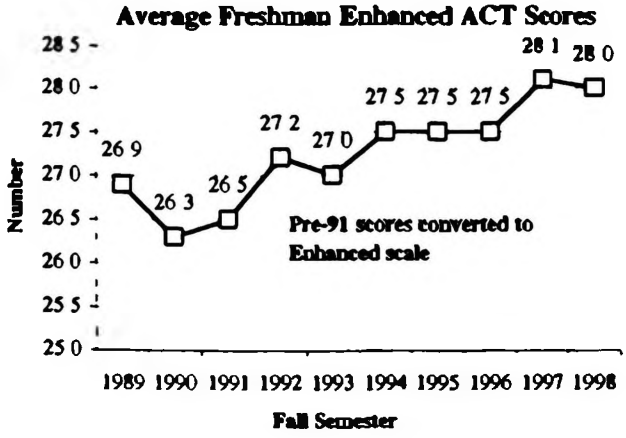


Figure 6

Students from over 44 foreign countries comprise 43% of the on-campus graduate enrollment, a proportion reflected in engineering schools throughout the nation Of graduate students, 39% are from Missouri and 18% are from out of state Having 452 on-campus engineering graduate students places UMR in the top 50 engineering graduate programs in the nation

Transfer students numbered 234 in the fall of 1998 The largest sources of undergraduate transfer students are Missouri two-year colleges, providing 37% of our transfer students Missouri public four-year institutions supply 28% Other Missouri institutions contribute 11%, out-of-state institutions within the United States contribute 21%, and foreign institutions contribute 3%

Seventy-seven percent of UMR students received long-term financial aid during the 1997-98 academic year The average amount of aid per student was just over $8,757, and the total financial aid at UMR was over $38,000,000, both figures being comparable with public institutions of UMR's size Loan assistance comprised 33% of all financial aid Of the financial aid, 36% came from federal sources, University funds provided 53%, with the remaining 11% coming from state and other sources In fiscal year 1998, 807 (or 28%) of in-state undergraduate students were awarded the Missouri Higher Education Academic Scholarship ("Bright Flight") This is the highest percentage per enrollment among the four University of Missouri campuses, another indicator of the high quality of UMR's undergraduate student body

The default rate on the Ford Direct Loan and/or the Federal Family Education Loan was 6 5% in fiscal year 1996

The UMR Engineering Education Center on the University of Missouri-St Louis campus provides master's level instruction in Engineering and Computer Science, the latter constituting 22% of the enrollment in FS 1998 Because the University of Missouri-St Louis campus is adding a Master's degree program in Computer Science to its degree offerings, the

UMR Engineering Education Center will phase out its Computer Science program. Plans are being developed to offer graduate degrees in computer engineering and software engineering at the center to serve existing unmet needs Nearly all are part-time students who work full time at companies in the St. Louis area. Students at the Engineering Education Center meet the same admission standards as on-campus graduate students. Financial aid from the University is not made available to students at EEC Many have a portion or all of their fees reimbursed by their employer.

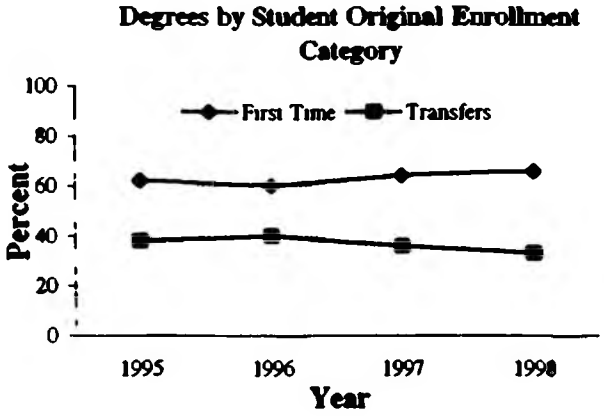


Figure 7.

Research Community UMR receives support for basic and applied research from the federal government, corporations, state government, and small business Expenditures for FY98 were $10 9 million (including indirect costs) of which 55% was from federal sources, 43% from corporate sponsors, and 2% from the state In addition to research, external funding also supports university efforts in instruction and public service and provides financial aid to undergraduate and graduate students During FY98, 358 proposals for external funding were prepared and 222 proposals were funded in the amount of $15 4 million. The top five departments in research expenditures in FY98 were Mechanical and Aerospace Engineering and Engineering Mechanics, Chemistry, Electrical and Computer Engineering, Ceramic Engineering, and Metallurgical Engineering, which together accounted for nearly 70% of the campus's research expenditures.

Research Funding Source: FY98

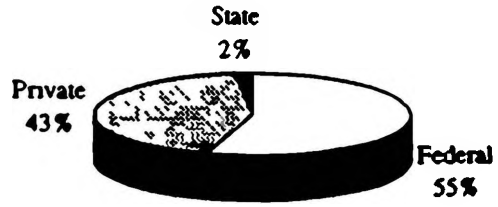


Figure 8

Outreach As an essential component of its land grant status, UMR seeks to serve other than students, employers, and the research community, especially through its outreach and extension activities. Included in this group are state and local government, particularly in efforts to enhance economic development Since 1964, more than 2,200 master's degrees have been awarded by the Engineering Education Center in St Louis — thereby proving to be a major technological, educational resource for the greater St Louis region UMR also serves the community of Rolla and the surrounding area through the economic

activity it stimulates as well as the educational/ cultural/entertainment activities it offers to the public

UMR is one of the 47 leading engineering schools in the United Sates which are members of the National Technological University, which offers master's degree programs via satellite and videotape to practicing engineers in more than 60 corporations nationwide Members of UMR's Department of Engineering Management have been honored for outstanding educational contributions by the National Technological University in recent years Over the past nine years, UMR has provided 105 Engineering Management graduate credit courses to 1,745 students and 97 non-credit short courses to over 2,215 students

Educational, service, research, and training programs in countries abroad are coordinated at UMR by the International Affairs Office Activities include aiding institutional development, short courses, specialized training programs, cooperative linkages with institutions in other countries, credit courses, and aid to both international students attending UMR and U S students and faculty members planning travel abroad. Such linkage programs facilitate cooperative research, teaching, and exchange of faculty and students Linkages presently exist with institutions in Belgium, Brazil, Peoples' Republic of China, Republic of China, Egypt, England, France, Federal Republic of Germany, India, Ireland, Jordan, and Poland Several further linkages are being actively pursued In addition, courses and specialized training in technical subjects are provided to private companies and international agencies

A noteworthy success has been the exchange program, sponsored by the Jefferson Smurfit Foundation, linking UMR and University College Dublin (UCD) This activity has been underway for over 30 years and has supported over 60 faculty exchanges and 36 student exchanges. Although primarily focused on students earning master's degrees, recently UMR undergraduates have experienced the UCD educational environment for the first time and UMR students began M S and Ph.D. programs at UCD in fall 1998

UMR's Impact

The University of Missouri-Rolla has a profound impact on the state of Missouri, on the nation, and on its local region

UMR's graduates are increasingly recognized nationally and internationally for the quality of their education.

Table 1.

Competitor Institution	Share of Nonenrollees
University of Missouri-Columbia	15 6%
U S Service Academies	8 0%
University of Illinois	5 3%
Purdue University	5 3%
Washington University	5 3%
University of Missouri-St Louis	3 6%
University of Kansas	3 0%

Because UMR has been the center of technological training in Missouri for over 125 years, the impact of the campus on the state has been far-reaching As of FY99, approximately 15,000 alumni presently live and work in the state, and 71% of current undergraduate and graduate students are residents of Missouri

Moreover, the campus is known statewide as the source of practical solutions to technical problems Since 1988, UMR faculty members have participated in over 90 collaborative research projects with Missouri firms under the aegis of the Missouri Research and Training Center In this program, state funds, support from collaborating companies, and federal support are leveraged to support research projects that have measurable benefits for the Missouri economy

UMR offers the only baccalaureate degrees in Missouri and the region in ceramic, geological, metallurgical, mining, and petroleum engineering and management systems

Many factors contribute to the effect of UMR on its students, its community, and the region The campus is a concentration of goal-directed people — students, faculty, and staff — and because the town of Rolla is relatively small compared to the campus, and because the campus is the focus of most of the cultural events in the area, the influence of the campus is great The selection of such events in Rolla is broader than would be expected in a rural Missouri town, the plays selected for student performance are diverse and contemporary and draw community audiences The musical programs offered are particularly ambitious — ranging from the Miner Band and holiday season Madrigal Dinners to the symphony

The high standards of the university community have been adopted by the local school systems and benefit the entire region

Overall, UMR and Rolla are a unique combination of a rigorous and comprehensive engineering and scientific university, an accomplished and ambitious liberal arts faculty, highly qualified and diligent students, a rural county seat, and a scenic setting

UMR's Competition

UMR's competitors have been determined from surveys of students who have been admitted to UMR but have chosen to enroll at other universities The top seven competitors, and the percentages of nonenrollees attending these institutions, taken from a 1986 survey, are listed below

Each of these institutions possesses a wide range of programs and is generally regarded as academically strong Comparisons of in-state student costs with those of competitor institutions show relatively small differences except for Washington University, which is a private university Each of the competitor institutions has a significantly larger enrollment and, except for the University of Missouri-St Louis, a broader range of degree programs

Missouri's regional universities do not appear to be significant competitors These institutions, which have costs that are typically

two-thirds of UMR's, do attract large numbers of Missouri students Although none has a four-year engineering program, several have pre-engineering programs and compete with UMR for freshmen interested in engineering. Eventually these students must transfer to UMR or another university to complete their engineering degrees. Transfer students now constitute 24% of new undergraduate students at UMR and two-thirds of these transfer students come from other Missouri two-year and four-year institutions.

Surveys of admitted nonenrollees point to three factors that affected their decision to attend another institution. These are cost and financial aid (28%), campus life (23%), and academic reputation and major (20%) Informal surveys of enrolled UMR students indicate that these are the very factors that lead students to enroll at UMR and are consistent with national surveys of college-bound students.

A study of competitors suggests that UMR's "niche" is that of Missouri's principal technological campus This implies a primary focus on meeting the engineering and applied science education and research needs of the state, and indeed the nation. In addition, the campus has the associated and essential responsibility for the science and liberal arts needs of the engineering and applied science programs as well as that of serving the general education requirements of the south central portion of Missouri

Benchmark Institutions

It is testimony to UMR's unique history and nature that few other institutions in the country have had a parallel development. The Missouri Coordinating Board for Higher Education, in a comparative study, chose the Georgia Institute of Technology, New Jersey Institute of Technology, and the South Dakota School of Mines and Technology as peer institutions for UMR, although each of these institutions differs in important ways from UMR. Michigan Technological University in Houghton, Michigan, may be a more useful benchmark institution because of its size, location, and emphasis on engineering and science. Even this comparison falters in terms of proportion of students enrolled in science and engineering, as the proportion of UMR students enrolled in these areas is somewhat higher than at Michigan Tech and is second nationally only to the Colorado School of Mines. Over the past ten years, the University of Missouri System has increasingly used the public institutions within the American Association of Universities as benchmarks, primarily in examining the issues of faculty compensation and externally sponsored research productivity. UMR has used these benchmarks; indeed, a major goal of the five-year budget plan that was developed and implemented over the years 1992-1997 was to dramatically increase faculty salaries with the goal of attaining parity, within the constraints of discipline and productivity, with AAU

public institutions The goal has not been fully met although significant progress has been made.

While they are inappropriate as benchmark institutions, the universities with which UMR competes for engineering students certainly are worthy of attention and study. These include Purdue, University of Illinois-Urbana, Kansas University, University of Missouri-Columbia, and Washington University. It is interesting to note that each of these institutions is a comprehensive university with a much larger total enrollment. However, UMR's engineering enrollment is easily comparable to the engineering enrollment at each of these universities. Because of their traditional strength in mining, the Colorado School of Mines and Pennsylvania State University remain of interest to UMR as comparative institutions. Finally, because they are nationally eminent institutions of science and technology, M.I.T., the California Institute of Technology, and Stanford University often can provide insight regarding national trends in engineering and science education.

There are activities at these benchmark institutions that UMR is observing carefully.

First, every institution mentioned above is vigorously pursuing stronger relationships with and support from the private sector This manifests itself in cooperative programs of research and development, enhanced private fundraising, and joint ventures of mutual interest. This intensified cooperation appears to derive from the universities' interests in developing additional support for their programs and the private sector's desire for better access to people and technology. For several years, this trend was also enhanced by the widely shared belief that federal government funding of research and development would be static. The robust economy and relatively healthy federal budget of the 1990s have led to expanding federal support for research and development.

Second, every institution is making special efforts to strengthen its programs of graduate education and research. Of special note are the various multidisciplinary research centers and institutes that are focused on technologies and problems of current state and national interest (e.g , manufacturing, microelectronics, biotechnology). These research centers are typically a partnership of state, federal, and private interests involving multimillion dollar levels of funding. The focus of a center is often on a problem area or technology that relates directly to economic competitiveness of an industry or the economic development of a state.

Third, there is growing concern with undergraduate education. In particular, some universities have begun to study means of increasing the individual student's involvement in his/her own education. Some critics of higher education feel that the traditional sequence of lecture and laboratory courses in most degree programs makes observers of students rather than participants These critics feel that today's students are rather passive —

they lack the initiative and creativity that characterize successful lives — and are ill-equipped for the cooperative efforts characteristic of most employment opportunities. All concerned institutions, including UMR, are working to reverse this perceived trend

UMR's Self Image

An institution's perception of itself, however fluid and kaleidoscopic, has an effect on the day-to-day workings of the institution and on long-range planning. This is particularly true of a semiautonomous institution such as a university. At UMR there have been repeated efforts to gain an understanding of the image that the campus has of itself and presents to others. Surveys of student opinion have been conducted for several years covering topics from fairness of testing to social life. Faculty members have been surveyed periodically, as have alumni. In the last year there have been two Institutional Functioning Inventory and Institutional Goals Inventory efforts to quantify, to the extent possible, the various points of view of the faculty members on the campus.

In particular, UMR faculty members appear to feel that the campus comes closer than most to meeting the high standards set for academic development, and that research, advanced, and vocational training are given appropriately high levels of attention. In the area of community service, UMR faculty members feel that the campus is not achieving all it should.

Faculty members perceive UMR as a quality technical university with an emphasis moving toward research and graduate education from a strong background in undergraduate engineering education.

Students' opinions (ACT Opinion Survey) on specific issues — quality of food, library facilities, cultural programs, etc. — generally rate UMR about average among surveyed institutions. When rating the overall campus environment, students have displayed generally increasing and now fairly high levels of satisfaction with out-of-class availability of faculty and with their attitudes toward students. Freshman satisfaction with advising has risen and is quite high, but upperclass students are less satisfied with advising. The perception of UMR by students is that of a rigorous, engineering-dominated campus with too few women. Students also feel that they could receive more individual help from faculty members. There has been a consistent student concern about the quality of academic advising. In response to these concerns, one campus-wide seminar on advising has been held followed by several workshops.

ORGANIZATIONAL STRUCTURE AND RESOURCES

University of Missouri

Governance of the Institution

The University of Missouri is a constitutionally established unit of the State of Missouri: "The general assembly shall adequately maintain a state university and such other educational institutions as it may deem necessary." (The Missouri Constitution of 1945, article IX, SS 9a, 9b.) The Constitution also establishes a board of curators. "The government of the state universities shall be vested in a board of curators consisting of nine members appointed by the governor by and with the advice and consent of the senate." The Curators are given a wide range of power by statute, as summarized in the Collected Rules and Regulations of the University of Missouri, which are available for inspection.

The University of Missouri-Rolla is one of four campuses which comprise the University of Missouri system. The other campuses are located in Columbia, Kansas City, and St. Louis. The Board of Curators employs the UM system administration, which consists of the President of the University of Missouri, five vice-presidents, and various other administrative staff members. This group is responsible for implementing Board policy.

The State of Missouri also established a Coordinating Board for Higher Education (CBHE) in 1974 to serve as a clearing house for budget development and program coordination for all of Missouri's public higher education. The Coordinating Board has statutory authority to approve degree programs at all public institutions within the state of Missouri.

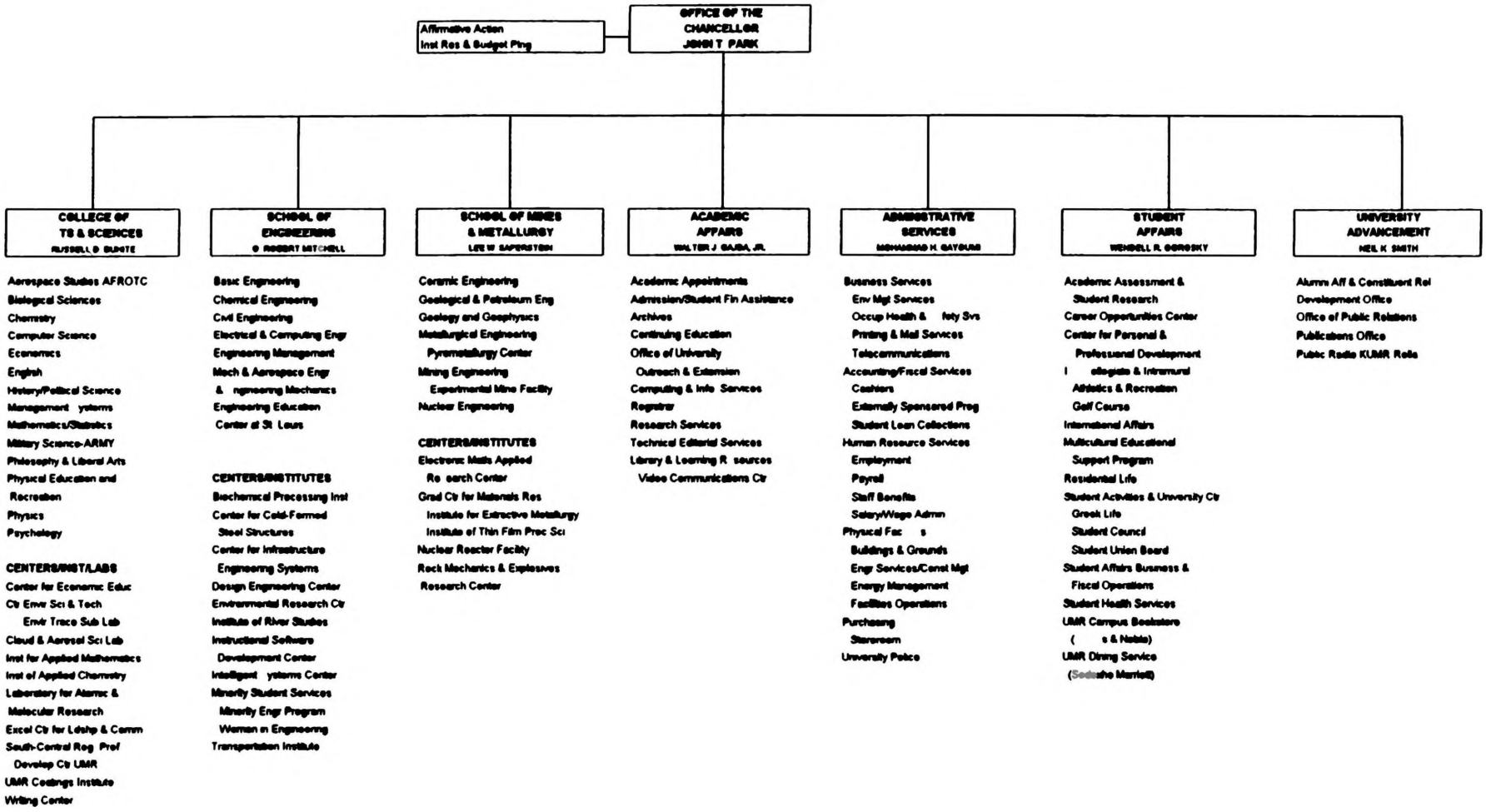
The Board of Curators is not subordinate to the CBHE but works with it to establish coordinated legislative requests for funding of higher education and to maintain a comprehensive program of higher education for the citizens of the state. The CBHE works with the president and the Board of Curators to coordinate budget requests for all state colleges and universities.

The University of Missouri System Administration plays a dominant role in budget presentations to state government — the major source of revenue (40% in FY98) for the campus. Budget proposals are prepared on the local campuses but are required to pass through two consolidation processes — one at the system level, where one budget for the four UM campuses and the UM system administration is generated, and one at the state level, where one budget for all of public higher education is generated by the Coordinating Board.

The governor submits a proposed state budget, including a higher education budget, to the legislature. Finally, the legislature passes a proposed budget and submits it to the governor, who has line-item veto authority.

Once financial resources are allocated to the campus by the President, as approved by

UNIVERSITY OF MISSOURI - ROLLA
ORGANIZATIONAL CHART



the Board of Curators, the UM system delegates significant administrative responsibility and authority to the local campus, which permits the campus to focus its total resource package on its own priorities for carrying out its mission and purposes.

There is a clear understanding by the Board of Curators of UMR's role within the University of Missouri. In fact, the long range planning process initiated by the Board has served to focus and strengthen UMR's mission and to make UMR unique among institutions in the State. Certainly, this approach has enhanced UMR's ability to carry out its mission and purposes.

University of Missouri-Rolla Administrative and Academic Structure

Each of the four University of Missouri campuses has a chancellor who serves as the chief executive and academic officer for the campus. At UMR, four vice-chancellors (Academic Affairs, Student Affairs, Administrative Services, and Advancement) and three academic deans (Arts and Sciences, Engineering, and Mines and Metallurgy) report directly to the chancellor. Each academic department is in one of the three schools and is administered by a chair. All academic and most nonacademic units report through either a dean or a vice chancellor, as shown on the organizational chart.

The Board of Curators has provided for faculty participation in academic governance by approving the Bylaws of the Faculty of the University of Missouri-Rolla. According to the preamble, the Bylaws are adopted "to facilitate communications and to provide for effective academic governance, for participation in decision making, and for shared responsibility in academic affairs". In accordance with the Bylaws, the faculty is organized into departments, schools, colleges, the graduate faculty, academic council, and standing committees. Provision for faculty governance and for input to the administration is made through the legislative and policy-making body of the faculty, the Academic Council. The Council carries out the functions and responsibilities assigned to it by the General Faculty and considers matters referred to it by the Board of Curators, the President of the University, the Chancellor, and members of the faculty. Representatives to the Academic Council are elected by the departments (one representative/ 10 full-time faculty members). The chancellor, vice-chancellors, and deans are ex officio voting members of the Academic Council and the chancellor may appoint ex officio nonvoting members. Student representatives are selected by the Student Council (one/1000 undergraduate students), and the Council of Graduate Students (one representative/1000 graduate students) Student representatives have all privileges except voting. The Academic Council maintains standing committees in order to make decisions on academic matters and provide advice on budgetary affairs, student affairs, etc. The standing committees of the Academic Council are listed and briefly described at UMR's web site.

Student Council

Students participate in academic governance in two ways. The UMR Student Council has as its purposes to represent the student body in its relations with the faculty and the administrative officers of the campus and to coordinate and regulate student activities. In addition, as noted above, representative students participate in the Academic Council with all privileges except voting, and students serve on appropriate standing committees.

The Student Council provides the mechanism for discussion and debate whereby all students may have a formal voice in campus affairs. Membership is composed of representatives from organizations approved by the Student Council for representation, and by representatives of unaffiliated students. The Council can petition the faculty on various matters, and the Council provides a forum for student opinion. The Student Council determines distribution of funds for selected programs with the funds coming from the student activity fee. Students also have input into the use of the instructional computing fee. Graduate students are represented by a Graduate Student Council which operates similarly to the Student Council.

Structural Adjustment

The basic administrative structure has been in place since 1964, when the University became a four-campus system; however, some restructuring and title changes have occurred over the years. In 1987, the position of Dean of Students was elevated to vice-chancellor status consistent with the importance of the associated activities. In 1994, the position of Vice Chancellor for Student Affairs was renamed Vice Chancellor for Student and International Affairs to emphasize the increasing importance of international recruiting and relations in the priorities of the campus. The position of Provost was changed to Vice Chancellor for Academic Affairs and that of Director of Alumni/Development to Vice-Chancellor for University Advancement in 1984. The Campus Business Officer was elevated to Vice Chancellor for Administrative Services in 1983 in order to be consistent with the other University of Missouri campuses.

Graduate Affairs

As mentioned above, the Graduate Office was dissolved as a result of the five-year budget plan formulated in 1992-93 and implemented over the following five years. The policy and procedures of the graduate program are formulated by the Graduate Faculty, acting through an elected graduate council which advises the Vice Chancellor for Academic Affairs and the Chancellor. Within each of the three academic divisions is an associate dean who, working with staff, ensures that graduate activities at UMR are consistent with the guidelines established by the graduate faculty. The divisional offices maintain records on all graduate students enrolled.

At the academic department level, the Department of Electrical Engineering has added

three (B.S., M.S., and Ph.D.) degrees in computer engineering and its name has been formally changed to the Department of Electrical and Computer Engineering. As part of the mission enhancement initiatives mentioned above and detailed later in this report, additional faculty positions were added to the Department of Electrical and Computer Engineering and to the Department of Computer Science to meet the increased student needs which the new degrees are expected to generate.

Within the College of Arts and Sciences, a new interdisciplinary B S. degree program in Management Systems was proposed and approved in 1991 by the Coordinating Board for Higher Education The first students were enrolled in Fall of 1991, and the first graduate walked in the Fall of 1993 commencement ceremony. The number of majors has continued to grow, contrary to campus enrollment patterns. As of January 1999, 65 majors were enrolled, making it the third largest major in the College of Arts and Sciences. Consistent with the original intent of the program, most of the majors are students who formerly had other UMR majors and were seeking a technical, employable, and broader major. Few freshmen come to UMR to major in Management Systems which is an area of potential growth for Arts and Sciences. In addition, the department of life sciences has changed its name to the Department of Biological Sciences, which the faculty believes to be more reflective of the department's activities.

The administrative structure appears to be well-suited to carrying out the mission of a University system consisting of unique campuses serving diverse interests. The roles of the individual campuses are well defined, particularly sharply in the case of UMR, and substantial administrative authority is delegated to the campus level. This make it possible to respond to campus needs in a timely fashion.

In terms of the UMR campus, the size and the close working relationship which exists among principal administrators leads to amicable and rapid resolution of problems in most cases. There is a good deal of interaction between academic and support administrators at all levels, which leads to wide understanding of many types of problems, with the result that the institution's mission can be accomplished effectively.

On the surface it may appear that having two schools, Engineering and Mines and Metallurgy, responsible for engineering programs is unnecessary. However, the long tradition of the campus relating to the instructional and research programs within the School of Mines and Metallurgy and their relatively small size compared to most programs within the School of Engineering, means that their identity and strong alumni support is preserved through separate administration. This helps the campus continue to serve the extremely important energy,

materials, minerals, and environmental service industries in Missouri, the nation, and the world. Research carried out in the School of Mines and Metallurgy has traditionally been focused on the fundamental materials used by society — their origin and utilization, and this research program continues to provide vital results.

At UMR, academic and nonacademic administrators undergo a yearly performance review by their immediate supervisor. Every five years the academic administrators undergo an in-depth review by faculty and staff of the units they administer. This process is essential in order for the campus to continue to accomplish its purposes. A recent policy change, based upon a report from a combined faculty, staff, administration committee with review and support from the Academic Council, will lead to annual reviews of deans and vice chancellors by the chancellor, who will be advised in each review by a committee charged with seeking information about the person being reviewed from those who work most closely with that person. In the past, the five-year reviews tended to solicit information broadly from the community, and the results were difficult to interpret. The policy change is intended to lead to more frequent, in-depth reviews with more useful feedback to the chancellor and the individuals being reviewed.

The chancellor holds regular staff meetings with deans, vice chancellors, the director of institutional research, and the assistant to the chancellor for affirmative action and equal opportunity. Faculty members, students, and staff serve as members of administrative committees. Academic and nonacademic administrators serve on the Academic Council. Department chairs meet regularly with their respective deans and meet regularly as a campus committee. However, without a representative on the Chancellor's Staff Council, continuity between the two administrative levels is difficult to maintain The chancellor holds yearly retreats with senior administrators. Faculty members, staff, and students participate in the planning processes Students, staff, and faculty members take their participation in governance seriously and work diligently with the administration in planning and in implementing these plans. This structure facilitates rapid review of all problems and opportunities at the top and provides a mechanism for a team effort in Administration

SUPPORT SERVICES STRUCTURE

Library

The Curtis Laws Wilson Library is considered a prime learning resource on the campus. Its major objective is to provide access to printed materials and electronic information to support UMR's instructional and research programs. The library has a strong collection in science and technology, and the humanities-social sciences collections have grown to support developing programs in those areas.

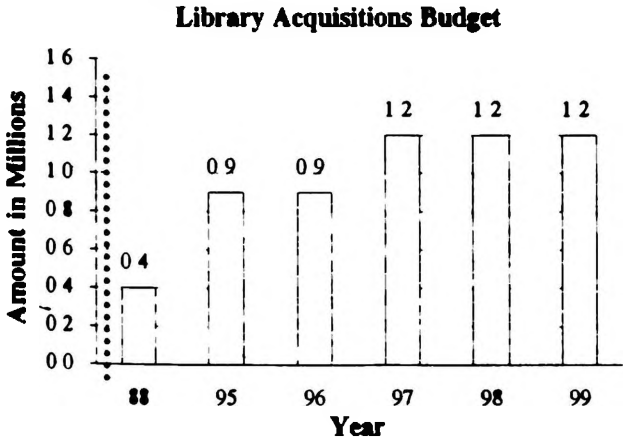


Figure 9

The library has recently undergone a needed renovation at a cost of just under $3 million. The overall ambience and work environment of the library has been significantly improved. Notable are the improvements in heating, ventilation, air conditioning and lighting. Also, the study areas now incorporate connections for portable computers and enhanced group study space. In order to meet federal regulations associated with the Americans with Disabilities Act, stack aisles were made wider. As a result, a number of older, infrequently used volumes were moved to an off-site storage facility — the University of Missouri Libraries Depository. Retrieval of materials located in this depository is comparable to interlibrary loan.

The library houses more than 370,000 volumes and currently subscribes to approximately 1500 periodicals. The print collection is supplemented by an active interlibrary loan service. Electronic access is considered critical to meeting users' information needs. The catalog is now fully computerized, and the catalogs of all campuses of the University of Missouri, St. Louis University, and Washington University are available on-line through a common, linked system. The six campuses freely share their collections with each other. The library also provides access to a wide array of databases, many of which provide not only pointers to the location of information but also the information itself in full text.

UMR is a partial depository for U.S. and Missouri government documents. The library receives a wide selection of materials, including such important resources as the U.S. Patent Gazette, the U.S. Geological Survey collection and the National Aeronautics and Space Administration publications.

Under the impetus of operating within a stringent budget and in an environment marked by rapid growth in newly published scholarly materials, the Library is placing less emphasis on being simply a repository and is placing

increasing emphasis on providing access to information wherever it is located to users wherever and whenever they may need it.

Computing and Information Services

The UMR Computer Center provides computer services and technical assistance for all types of computing on the Rolla campus. Staff members maintain programming systems and serve as consultants to those using computer equipment for instruction and research. The central facilities are available to all UMR faculty members and students. An "Introduction to the Computer Center", which contains a complete listing of services and equipment, is available from the Computer Center Office and will be on hand for inspection. The currently available campus computing hardware is summarized in some detail below.

The Computing and Information Services Office at UMR provides computing, networking, and associated technical assistance to all segments of the campus community. Staff members install and maintain servers, desktop systems, local and wide area networks, and serve as consultants to everyone who uses these facilities. Campus computing resources emphasize the instruction and research aspects of our mission Administrative computing has historically been performed on centralized systems located in Columbia, but the campus direction toward distributed desktop systems now increasingly requires the campus to also perform many administrative and support functions. Our primary goal is to create an electronic environment covering all aspects of UMR's mission.

Campus computing facilities are available to all faculty, staff, and students and include a wide range of general purpose and special function servers, workstations, personal computers, printers, and software. An extensive computer network interconnects all campus buildings; provides connections in all offices, laboratories, and classrooms; and attaches to regional, national, and international networks via the Internet. Areas identified for improvement include providing technical support for humanities and social sciences faculty and increasing staff so as to improve response time for assistance to faculty and staff.

Campus computing and networking facilities include the following.

General Purpose Computing

Two Hewlett-Packard 9000-J282 Servers provide general purpose UNIX interactive computing services for students and faculty An HP 735/125 provides batch UNIX computing services. Each HP 9000-J282 has 2 processors, 1 GB of main memory and 13 GB of temporary disk storage. They run the UNIX (HP/UX) operating system and AFS file system. A growing set of software products including compilers and applications is now available. This includes C, C++, Fortran, IMSL, ELM, WordPerfect, Maple, SAS, SPSS, Tecplot, FTP, Netscape, TN3270, and

University of Missouri-Rolla Computer Network

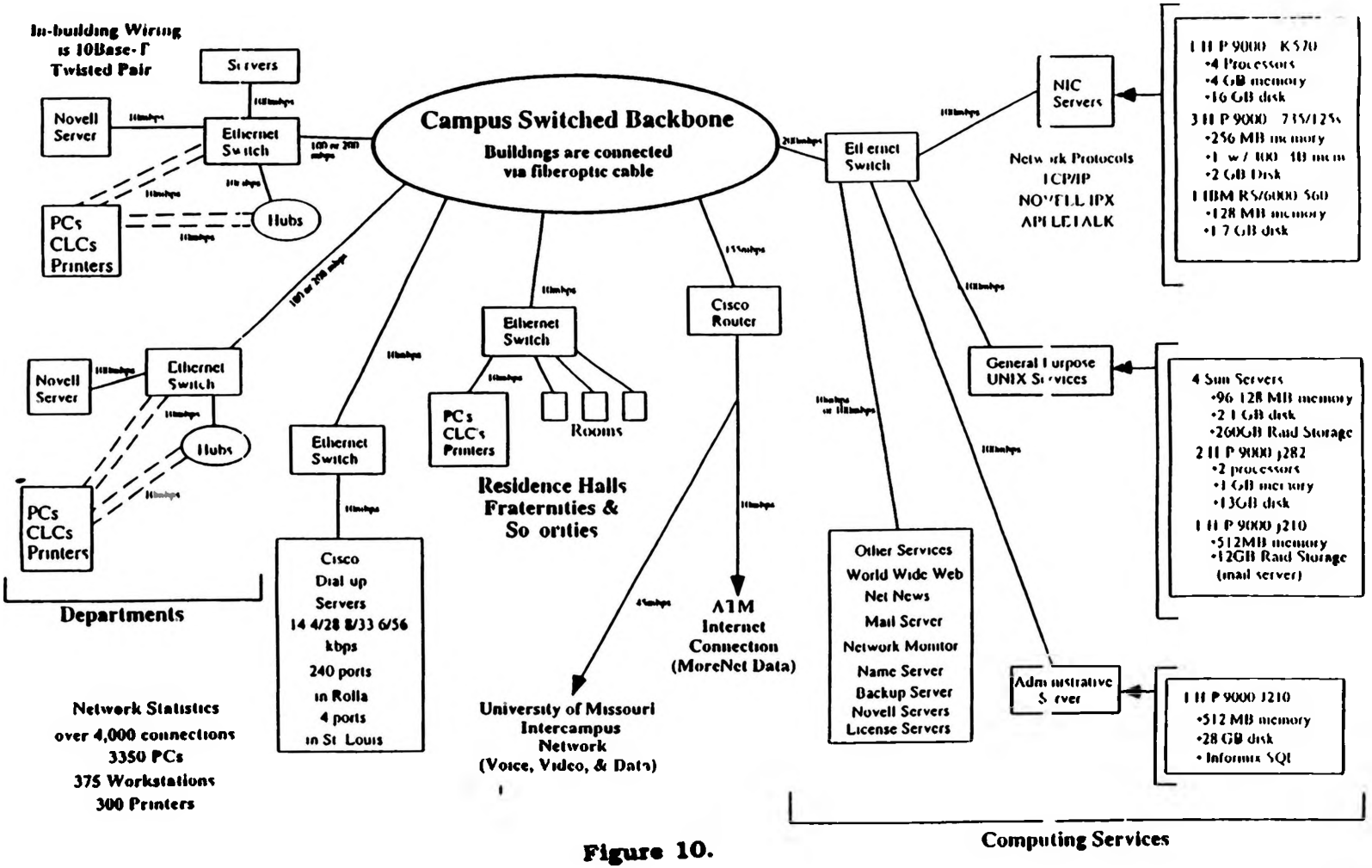


Figure 10.

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others. These products provide electronic mail, file storage, and computing facilities for almost all students and for many faculty and staff

Three SUN Ultra 1/140 or 170 Workstations running Solaris and AFS provide file storage for the general purpose UNIX servers listed above, numerically intensive computing servers, and for many desktop workstations located in Computer Learning Centers (CLCs) and faculty offices. These systems contain over 260 GB of direct access storage.

A Hewlett-Packard 9000-J210 delivers database services to the campus. This system has 512 MB of main memory and 28 GB of direct access storage. It uses the Informix version of SQL, but will be migrated to Oracle during the current year. Local applications include a Chemical Tracking System, Admissions System, Co-curricular Transcripts, and downloaded data base/reporting services. The database system is used to deliver campus-unique administrative systems and reporting services and to develop electronic processes on the campus World Wide Web Intranet.

An ever-changing array of SUN, Hewlett-Packard, and IBM workstations provide network and computing support services. This includes the World Wide Web, NetNews, Domain Name Service, electronic mail, TACACS, network monitoring, backups, and other services. While almost all of these servers run Unix, electronic mail is now delivered from Windows NT Servers using Microsoft Exchange as well as through SMTP. Servers are routinely upgraded and replaced to deal with the rapidly growing electronic communication at UMR.

Numerically Intensive Computing

A Hewlett-Packard 9000-K570 Server, two HewlettPackard 9000-735/125s, and one IBM RS/6000-560 provide the campus capability for high speed scientific and engineering calculations. The HP 9000-K570 provides the bulk of the numerically intensive computing. It has four processors, four GB of main memory, and 16 GB of temporary disk storage. The two HP 9000735s provide additional intensive computing. Each system has 256 MB of main memory and 2.0 GB of disk storage. All Hewlett-Packard systems run a UNIX (HP/UX) operating system and offer a variety of scientific and engineering software packages including Fortran, C, C++, IMSL, SAS, IDEAS, ANSYS, ASPEN, ABAQAS, FLUENT, Mathematica, Maple, and NASTRAN.

The IBM RS/6000 has 128 MB of main memory and 1.7 GB of disk storage. It runs a UNIX (AIX) operating system and offers a set of scientific applications that includes Fortran, C, IMSL, ABAQAS, FLUENT, and NASTRAN.

File service for numerically intensive computing is provided by the SUN workstations listed previously. The file systems allow individual researchers and departments to run their applications and store data as well as install and maintain additional software packages.

Personal Computers and Workstations

More than 3,300 IBM-compatible and Apple personal computers have been placed in campus departments. The machines include a wide range of systems from older models to the most modern Pentium PCs and Power Macintoshes. The largest number of machines are IBM-compatibles. Recent projects emphasizing desktop computing have replaced most 486s and similar Macintoshes though a few older machines are still used in campus laboratories for data acquisition and real-time control. This replacement has allowed the campus to standardize on Windows 95. A move is now underway to migrate many machines to Windows NT.

In addition to frequent updating of campus computers, emphasis has been placed on connecting all computers to the campus network. It is our belief that all faculty and appropriate staff are now equipped with personal computers which are connected to the campus network. Many personal computers obtain software, direct access storage, and printer sharing from Novell NetWare Servers. Site licenses and bulk purchase agreements provide many software products at low or no cost, including Microsoft Office, WordPerfect, QuattroPro, Eudora, Telnet, FTP, QWS3270, Netscape, and Maple.

The campus also contains more than 350 engineering workstations. While some provide campus services and have been mentioned earlier, many others are located in faculty offices, research centers, and Computer Learning Centers. All of these run a UNIX operating system and include systems from SUN, Hewlett-Packard, IBM, Silicon Graphics, and DEC. Most of these systems use the campus file servers and software, but some faculty and departments also install applications on their own systems.

The campus network also supports a large number of printers. Over 300 printers are now connected to the campus network to provide printer sharing for UNIX, Novell, and Apple networks. The vast majority of these printers are HP laser printers.

Computer Learning Centers

The public facilities containing personal computers, and/or workstations for student and faculty use are called Computer Learning Centers (CLCs). These rooms are located throughout the campus, including every academic open building, and are available to all students regardless of their home departments. CLCs are sometimes scheduled for classes during the daytime but are available for homework and independent study during the remaining daytime, evening, and weekend hours. Several CLCs are in operation 24 hours per day during the week and extended hours during weekends. Others allow special 24-hour key or card access. CLCs usually contain discipline- specific software as well as a set of campus wide products and often have a monitor who is capable of providing programming assistance. For example, the Basic Engineering CLCs offer AutoCad drafting and design software on IBM-compatible personal

computers while the Mathematics CLC provides visualization of mathematical concepts using Macintosh personal computers running Mathematica Another CLC houses the Center for Writing Technologies, which is equipped with high-end writing and desktop publishing programs and which is used for writing classes, workshops, tutoring, and individual student work on a wide variety of writing projects

There are currently over 40 public laboratories (CLCs) with over 800 computers. They contain approximately 570 IBM compatible and 135 Apple Macintosh personal computers, 115 workstations, and 80 laser printers All personal computers, workstations, and printers are connected to the campus network. In response to student requests, two of these facilities are located in residence halls, and one is located in a fraternity complex.

Novell NetWare Servers provide software and printer sharing and deliver a variety of software for IBM and Apple personal computers including (C++, Pascal, QuattroPro, WordPerfect, and Microsoft Office) as well as many scientific and engineering applications such as Maple, MatLab, MathCad, AutoCad, SAS, Mathematica, DeltaGraph, and PageMaker. In addition, many departments provide discipline-specific software

The CLCs contain high-end personal computer equipment. PCs are exclusively Pentium models with at least 32 MB of memory and a high resolution 14" or 15" color monitor In many cases, they include 17" color monitors. There are a variety of other peripherals including scanners, zip drives, CD-ROM drives, and other special purpose add-ons. The Apple computers are exclusively PowerMac models with high resolution 14" color monitors. In addition, all of the CLCs have quality laser printing devices.

The campus has also installed over 115 highfunction engineering workstations in CLCs. These systems are primarily from HewlettPackard and SUN, but there are others from IBM and Silicon Graphics These systems provide a Unix environment with high-resolution graphics, fast processors, large direct access storage devices, and sophisticated software. Software includes many standard engineering and scientific applications: IDEAS, ADINA, ANSYS, ABAQAS, FLUENT, AutoCad, Mentor Graphics, TeX, MatLab, ASPEN, Mathematica, Maple, Unigraphics, and ProEngineer.

Networking

Computing and Information Services maintains an extensive campus computer network. A campus backbone provides a mechanism for interconnecting local area networks at UMR to each other, to other campuses of the University of Missouri, and to the national research and education communities. Over 4,000 computers and printers are now connected to the network.

The campus network employs fiber optic cable, 10Base-T building wiring, routers, switches, hubs, Ethernet cards, servers, and

software to create an open systems network based on the TCP/IP suite of protocols. Cisco routers provide the backbone routing and connect to various buildings via fiber optic cable. A campus backbone network now connects a number of buildings using 155 mbps ATM while others are connected via 100 or 200 mbps Ethernet. Some smaller sites as well as all desktops are connected with standard 10 mbps Ethernet. Intelligent hubs and switches provide the connections within buildings. Most campus Novell Servers and a few desktops now employ 100 mbps Ethernet.

The campus network supports an extensive, heterogeneous environment. The primary supported services are Domain Name Service, backup services, file storage, printer sharing and communications services such as TELNET, TN3270, FTP, and SMTP. Network applications include the World Wide Web, NetNews, and electronic mail. The UMR network also provides a mechanism for interconnecting vendor specific protocols. Computing Services currently supports several additional local area network protocols including Novell IPX and AppleTalk.

Computing Services works with departments on the installation of a standard internal twisted pair wiring scheme (Category 5 - 10BaseT) and maintains or assists with management of departmental networks through hardware and software support activities. There are at least 40 Novell NetWare Servers delivering software and printer sharing to the campus. A number of UNIX workstations also provide network-based file, software, and printer sharing using AFS.

The campus proper has been wired since 1994. We believe that all faculty and appropriate staff computers are now connected. Work is progressing on completing wiring in the residence halls. Approximately 80% of the residence hall rooms now have campus network connections with additional wiring scheduled each summer. A significant project to extend the network via fiber optic cable to fraternities and sororities was completed in September of 1998. Fraternity and sorority network desktop computers may now be attached to the network in the same fashion as residence hall machines.

Now that the physical network is in place, development activities center on extending the use of electronic processes and communication in all phases of university instruction, research, and administration. These activities are now commonly delivered through World Wide Web facilities.

A large number of dialup ports (288) extend access to campus computing services to offcampus sites. A large portion of these are 56 kbps with the remainder 33 6/28 8/14.4 kbps

The Missouri Research and Education Network, known as MoreNet, connects the four University of Missouri campuses and other state universities. This provides easy access to Missouri universities, a growing number of state agencies, secondary schools, and libraries. MoreNet is also connected to the

Internet (national and international networks) UMR now has a 10 mbps connection to MoreNet and to the Internet. Total bandwidth of 45 mbps for the intercampus connection allows video, voice, and data traffic to other campuses and allows for upgrades as the data load demands. Our connection provides access to numerous other educational institutions, research facilities, libraries, information providers, vendors, and supercomputer centers for computing and information services within the United States and across the world.

Other Computing Equipment

Additional computing equipment is located in individual departments and research centers and is used to support the unique instructional and research activities of those groups. This includes a parallel processor in Computer Science, special function servers, and workstations.

Departments also provide many personal computers including those located in laboratories, graduate student areas, and faculty and staff offices. Most are attached to the campus network. Departments also provide discipline-specific software for Computer Learning Centers and other department functions and sometimes provide their own support staff

UMR campus computer users also have access to significant computer resources associated with the University of Missouri located in Columbia. The Central Computing Facility provides administrative computing services to all UM campuses, including the University of Missouri-Rolla. Their equipment includes an IBM 9672-RB5 mainframe and an Oracle-based Data Warehouse. These systems are connected to the campus network via the high-speed fiber optic facilities mentioned earlier in this document. A major project is now underway to replace mainframe administrative systems with client/server software from PeopleSoft.

Nuclear Reactor

The UMR nuclear reactor is used for educational purposes, research, and training by several departments. It is used to instruct students in its operation and capabilities for future research. The reactor is of the "swimming pool" type, the most desirable for education and training programs. The pool, a thick-walled pit, 19 ft long, 9 ft wide and 27 ft deep, contains 32,000 gallons of high-purity water. The fuel used in the reactor is U-235 in the form of MTR elements. The elements are 3" by 3" by 36" and may be used in many combinations.

The versatility of the reactor is such that a variety of experiments and irradiation services can be performed. Auxiliary equipment includes a pneumatic transfer system used for sample irradiation, counting equipment, a graphite thermal column, a beam port, a Ge(Li) detector and an associated multichannel analyzer.

Video Communication Center

The Video Communication Center provides media support for both on- and off-campus clients. This is accomplished by using state-of-the-art technologies to produce,

deliver, and receive a wide range of promotional, instructional, and two-way interactive programming. The VCC is UMR's link to the University of Missouri Video Network (UMVN), a two-way video and audio teleconferencing network which joins the four campuses of the University System. The system may be used for teleteaching of classes in various subject areas and can potentially make available to all campuses the expertise and course offerings of any of the campuses. The UMVN is also used for teleconferences, and for meetings among representatives at two or more of the campuses. Operating the only satellite TV uplink facility in south-central Missouri, the VCC broadcasts classes and short courses nationally on a regular basis. As part of the National Technological University, courses are delivered via satellite from UMR to universities, corporate facilities, and government agencies. The VCC has the capability to receive TV programming from any satellite accessible from North America. Programs received off satellite can be taped or distributed by fiber optic cable to a number of meeting rooms and auditoriums on campus. Recognizing the variety of ways that television, video, and other electronic media can be integrated into the educational process, the VCC enables students to benefit from an emerging technology

The VCC has played a significant role in designing, equipping, and supporting several electronic classrooms on campus. The most recent example is H/SS 201, which was designed by humanities and social sciences faculty. The VCC staff worked effectively with the faculty to utilize advanced technology to generate a seamless integration of video, audio, and computer-based learning with the more traditional forms of instruction.

Office of Admissions

The Office of Admissions is the initial contact for students applying for admission to either undergraduate or graduate programs. Student recruitment is the major admissions undertaking. The office attends or has representatives at over 1550 high school college fairs and other functions per year, and it sponsors more than twenty programs each year. In addition, the office processes the admissions of students to the Engineering Education Center in St. Louis and the facility at Ft. Leonard Wood.

The Admissions Office has developed the Transfer Assistance Program (TAP) to aid students attending two- and four-year local colleges in preparing to transfer to UMR. TAP gives the prospective transfer student a UMR student ID number and ensures that all courses taken successfully are transferred. UMR currently has TAP agreements with more than 40 institutions in Missouri, Illinois, Arkansas, Kansas, and Kentucky.

Minority students are recruited intensively. UMR has transfer agreements with junior colleges in Kansas City and St. Louis that enable minority students to enter the engineering program at Rolla as juniors, after taking two years of preparatory courses locally. All

such transfer students are eligible to be considered for the minority engineering $500 transfer scholarship In addition, St Louis students may qualify for one of several scholarship programs supported by Emerson Electric Company and Boeing St. Louis Sprint is now supporting a program in Kansas City similar to that supported by Emerson Electric in St Louis

To aid in recruiting able high school students, a customized tracking system and database (ADMS) have been developed. ADMS keeps track of students once the initial contact has been made and organizes correspondence, visits, and other contacts

Office of the Registrar The Office of the Registrar maintains student records, administers registration, schedules classroom assignments, prepares enrollment reports, acts on residency applications, acts as VA officer for the campus, and works with other units.

The Computerized Academic Progress System (CAPS), implemented in fall 1987 and upgraded several times in the intervening eleven years, is a computerized degree audit system, which provides semester-by-semester tracking of a student's progress toward graduation — permitting potential problems to be identified early. CAPS has been in place for all entering undergraduates since the fall of 1988 Significant strides in on-line registration have been made over the past several years with the gratifying result that UMR students, in annual surveys, have consistently given the registration experience a rating well above average

Student Financial Assistance A large number of UMR students receive financial assistance of one kind or another, about three-quarters received aid in FY98 The task of administering this aid and of complying with the applicable federal, state, and campus regulations falls upon the office of Student Financial Assistance The office uses a Student Aid Management (SAM) software system to help in granting assistance and packaging, reporting, updating, tracking, and notification of awards In the fiscal year 1998, the total amount of student aid was over $38,268,984

UMR graduates have one of the highest rates of repayment of student loans in the country In fiscal year 1996, the last year for which figures are available, the default rate for the Federal Family Education Loan and/or the William D Ford Federal Direct Loan was 6 5%

STUDENT AFFAIRS

Academic Assessment and Student Research

Institutional Assessment was formally established in 1987 to help assess the educational progress of UMR students and also to aid in better defining institutional attitudes and goals. An annual program of student assessment has been developed and is refined continuously.

A number of student beliefs and behaviors are tracked from prior to their entry to the university through Cooperative Institutional Research Program (CIRP) results, through the freshman year, into the sophomore-junior juncture, and immediately following students' graduation, using both standardized and locally-developed surveys. This information is fed back to the campus systematically and is incorporated into the workings of departments and committees. The Retention Committee, for example, has utilized these results frequently in the last few years. Some of the assessment data, and data gathered from all departments within the Division of Student Affairs, are now being compiled as the Student Affairs Source Book, published each winter semester since 1996-97. This publication represents an attempt to pull together important information from all Student Affairs departments into one convenient reference which is disseminated to all campus departments and occasionally used for off-campus constituencies. It is also available on the Assessment Office web page at http://www.umr.edu/~assess.

The assessment activities are coordinated by the director of Academic Assessment and Student Research. The Academic Profile test is administered annually to all rising juniors. Results from this test of general education attainments are supplied to chairs, deans, and individual faculty advisors and to the students taking the exam to ensure feedback to students regarding strengths and weaknesses and thereby inform student choice of general educational electives remaining to be taken. As of this year, individual results are provided to students as well.

Each academic department administers a senior assessment examination, many in conjunction with a required capstone design course. The Fundamentals of Engineering (FE) exam is used in most engineering departments, whereas the Major Field Achievement Test (MFAT) or GRE subject exam is used in most A&S departments. The information from the senior assessment exam is used by chairs and faculty to improve curricula.

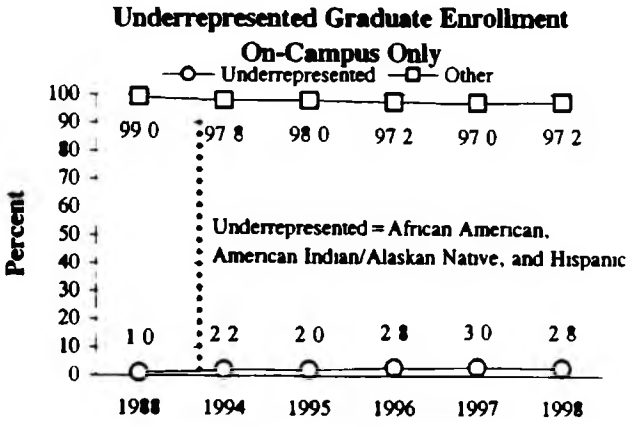


Figure 11

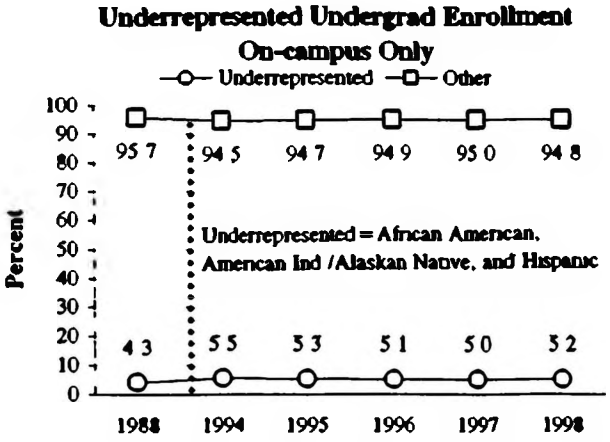


Figure 12

Although assessment processes and data are much more widely used and understood than they were even a few years ago, the campus clearly has room for further development in these areas. It is encouraging to see the increased understanding of what assessment can mean for the campus in terms of informing decisions

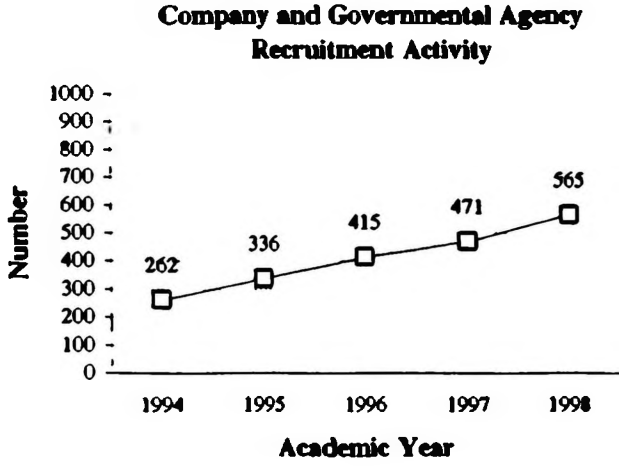


Figure 13

The Career Opportunities Center provides assistance to all students seeking full-time, summer, or co-op positions The staff is available to students to provide information regarding occupational goals and employer data via individual appointments and workshops/ presentations. In 1997-98, 565 companies recruited for co-op, summer, and full-time positions In the same year, 5,868 students interviewed for full-time and summer positions. An additional 916 interviewed for co-op positions.

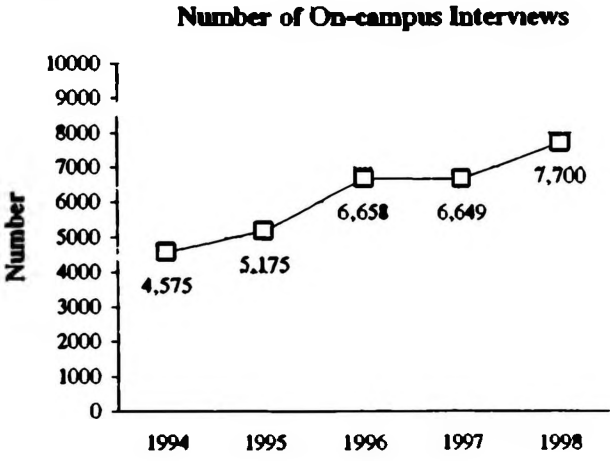


Figure 14

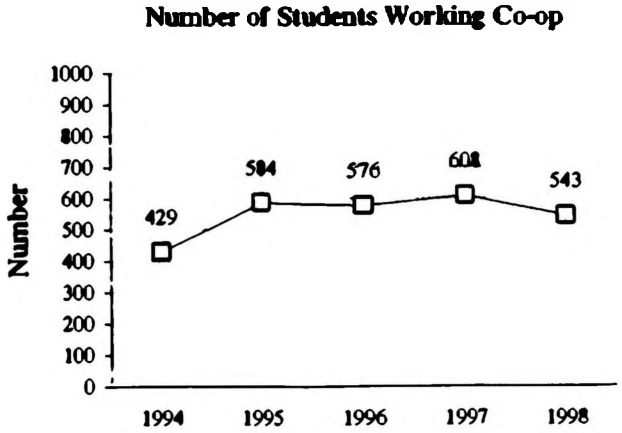


Figure 15

The Cooperative Education Program allows students to alternate periods of school with periods of training in industry

This helps students gain valuable training and experience, which aids both their academic and professional careers Six hundred students are involved annually A large number of industrial firms and agencies throughout the country participate in the program (154 in 1997-98).

Center for Personal and Professional Development (CPPD)

Preview, Registration, and Orientation (PRO) facilitates students' transitions to college through interactions with faculty, staff and students, provision of information on campus resources, and participation in math placement testing which builds their successful academic foundation

Personal, academic and career counseling is provided to students, faculty and staff on a time-limited basis. Services are free, confidential and provided by professionally trained counselors and/or psychologists. Several groups are offered throughout the academic year including Anger Management, Family-Based Issues, Sexual Abuse Survivors, Self-Esteem Enhancement, Career, and Student Success.

Learning enhancement and outreach programming services are offered to campus groups to promotes student learning and professional development. Common outreach programs include academic success, test anxiety, conflict resolution, and stress management. *Student Success Seminars* are provided to help students develop academic success strategies and utilize educational resources. *The VanMatre Resource Center* is a self-help library in the office.

Leadership Development programs are available to increase the leadership capabilities of all students and complement other campus leadership development efforts. *Promise Professional Plan* is a foundation to enhance the employability of all students Students prepare for the professional world by engaging in activities that build skills in teamwork, communication, leadership career management, and personal development. *Corporate Leadership Development Program* is designed for students who wish to move into corporate leadership positions at an accelerated pace. Students pursue experiences beyond *Promise* to further develop their communication, leadership, and personal skills *Scholar Development Program* is designed for students who wish to pursue research as an undergraduate and prepare for graduate programs of distinction. This program complements and builds upon The Honors Academy and Master Student Fellows Program.

The *Faculty Staff Assistance Program (FSAP)* is based on the Employee Assistance Program model and offers a variety of services such as counseling, consultation, organizational development, and training to faculty and staff

Intercollegiate and Intramural Athletics and Recreation

The *Intercollegiate Athletic Program* participates in Division II of the National Collegiate Athletic Association and in the Mid-

America Intercollegiate Athletic Association Men's varsity sports are football, cross country, soccer, basketball, swimming, golf, tennis, baseball, and track Women's varsity sports are basketball, softball, soccer, cross country and track The number of varsity sports is second highest in the conference Sixty-four percent of freshman athletes receiving aid graduate, compared to a 55% graduation rate for non-athletes The 1998 average cummulative GPA for the athletes is 3 175

Intramural Sports play a major role in the recreational and physical education program of UMR Students are given an ample opportunity to participate in some form of organized sport, whether they are affiliated with any special group or not. The objectives of the program are to encourage group cooperation and physical development and to provide fellowship and social recreation There are some 1,600 intramural contests in the 18 sports.

International Affairs (IA)

The Office of International Affairs (IA) coordinates international activities, administers all matters involving immigration for international students and scholars, and provides advisement services to the University's international population

The International Affairs office is responsible for the recruitment of international students and serves as a direct contact with U S government agencies, embassies, consulates, and the private sector concerning international activities International Affairs administers UMR's international exchange programs for students and faculty who wish to study, travel or work overseas and negotiates and offers educational programs, both domestically and abroad.

International Affairs coordinates and administers UMR's Applied Language Institute which houses the Intensive English Program The Office of International Affairs serves as the office responsible for the organization of international protocol activities and tracks the status of linkage agreements

Multicultural Educational Support Program and Service Learning (MESP)

The office was created in 1995 and sponsors activities for minority and majority students that encourages leadership development, educates students to university resources, assists students to achieve academic success, and provides campus leadership on diversity issues

The Southwestern Bell Cultural Center, opened in 1998, is a 7,000 square ft. building with a large open programming space, kitchen, gallery, student organization offices, Writing Across the Curriculum satellite office, a Computer Learning Center, an Academic Enhancement Center, and a Women's Resource area

Service Learning experiences for students are facilitated and acknowledged through the MESP office The office outreach program to the community includes: Agency on Aging, Big Brother/Big Sister and Habitat for

Humanity The 7th Grade Girls program with local school(s) provides young females an interactive experience with science and engineering

Diversity T E.C.H S. is a peer program that promotes the awareness and celebration of UMR's diverse student population. MESP also coordinates a Global Perspectives workshop for the Freshman Orientation (PRO) and the Faculty-Staff Assistance Program.

Residential Life Office

The *Residential Life* department provides on-campus student housing and oversees the contracted food services for the UMR community As a department within an academic institution, these services are provided with the intent of offering a variety of different living environments that support the UMR students' academic and lifestyle needs.

Over 2500 students live in seven residence halls (housing 1200 students), three apartment complexes (housing 80 students), and 20 university approved Greek houses (housing 1100 students) University housing provides students with a diverse assortment of academic living/learning opportunities. The residence halls and apartments are administered by UMR and staffed with professional live-in staff members The fraternity and sorority houses are independently owned, advised by the Student Activities office and subject to Residential Life's oversight with regard to their compliance with UMR's university approved housing guidelines. All living units are community oriented with a strong emphasis on enfranchising individual members with responsibility for the quality of the living environment.

As university-administered environments, the residence halls, apartments and fraternity/ sorority houses are a significant component of UMR's efforts to retain students, to foster their personal development and to enhance their academic performance. Our operating philosophy dictates that our residential services reflect residents' preferences Residents are strongly encouraged to be active community members and department staff are expected to foster self directed community growth Resident students are also provided with significant support resources that are intended to foster their personal and academic success

Student Activities and University Center

The *Student Activities* staff works with student organizations, provides leadership and risk management training for student officers, provides advice to fraternities sororities, advises the Student Union Board and student government and processes requests from student organizations to sponsor activities on university property.

The Student Council provides the mechanism for discussion and debate whereby all student body members may have a formal voice in campus affairs. The council consists of representatives from living units, campus organizations and off campus. Through

various electronic and manual mechanisms over 40 5% of the student body voted in the last student election.

The Student Union Board sponsors cultural, social, educational, and entertainment events including theatrical presentations by professional touring companies, lectures by noted authorities, a film series, recreational tournaments and games, concerts, and dances. A professional program coordinator works with the Student Union Board to plan these events.

Campus student media consist of radio station KMNR-FM, the *Missouri Miner*, and the *Rollamo* KMNR-FM is operated entirely by students, both in planning and broadcasting. Emphasis is on educational and entertainment matters of interest to the campus community. The *Missouri Miner* is the official weekly student publication and is written, edited, and published by students recruited from the student body at large. The *Rollamo* is the official student yearbook of UMR.

There are over 190 other student organizations in categories such as special interest groups, honor societies, service groups, cultural groups, social organizations, and student chapters of scientific and engineering societies These organizations are listed and described in the 1998-99 Student Handbook

The *University Center* complex consists of two connected buildings to create a gathering place for students, faculty, staff, alumni and guests Many campus services and programs are offered in the Center These services include food service, a bookstore, game room, cashiers and ticket sales, a canteen, meeting rooms, art exhibits, lectures and concerts The development of a major renovation and expansion plan for these facilities is in progress

The *Leach Theatre* is a 650 seat, state-of-the-art, facility used to assist in fulfilling UMR's mission of teaching, research and service. The primary purpose of the theatre is to provide a venue for the presentation of performing arts events. The facility also enhances sponsorship of cultural and other events that complement efforts to meet student's educational, cultural and life goals.

Student Affairs Office

Services for Students with Disabilities - The University places specific emphasis on accommodating the needs of students with a disability, providing related services and ensuring the academic integrity of UMR. The UMR Procedure Related to Students with Disabilities outlines the roles and responsibility of the student, staff and faculty, documentation procedures; and a grievance/complaint process The availability of reasonable accommodations is published in the Student Handbook, Undergraduate and Graduate Catalogs, post-admission voluntary disclosure form and at this website The services are coordinated through the office of the Vice Chancellor for Student Affairs

Code of Conduct - A student enrolling in UMR assumes an obligation to behave in a

manner compatible with the University's function as an educational institution. The "Standard of Conduct" and "Rules of Procedures in Student Conduct Matters" are printed in the "Student Handbook" and the "Student Academic Regulations" and can be found on the web at http //www umr.edu/~stu-aff/discipline.html These documents were updated by the UM system in 1994. It includes a section on Academic Dishonesty which defines "cheating," "plagiarism" and "sabotage". Allegations and charges of academic dishonesty are adjudicated by the faculty and the Vice Chancellor for Academic Affairs. All other violations are adjudicated by the Office of the Vice Chancellor for Student Affairs

Academic Enhancement Centers (AEC) - There is an AEC in each of the two Residence Hall Complexes, on Fraternity Row and in the Southwestern Bell Cultural Center. The program is coordinated by a Student Affairs staff member utilizing students to provide assistance in each center. Electronic and paper resources to assist students with study skills, test preparation, and specific subject content are available in each center. Outreach presentations and publications further disseminate their assistance.

Student Health Service

The Student Health Service is open 24 hours a day and is staffed by four part-time medical doctors, a psychiatrist and seven full-time registered nurses Services include consultation with physicians, prescribing and furnishing of medicines, emergency treatment for serious injuries, and hospitalization for minor illnesses. Should treatment be required for major illnesses or injuries beyond the capabilities of the center, optional student health insurance is available to cover costs of private care. In addition, a Health Educator provides individual and group assistance on wellness issues. TECHS, peer educators, provide programs for the campus community and give outreach presentations to student organizations and living units on substance abuse, sexual awareness, stress management, eating disorders, etc.

UMR Bookstore

The University Bookstore is the campus resource for purchasing required textbooks and supplies. The store sells reference books, educationally priced computer software, UMR emblematic merchandise and graduation products. Services include special ordering for non-stocked books, software and supplies A Textbook Reservation Program is offered to all incoming freshmen and upper class students Students leave their class schedule with the store and books are packaged and ready for pickup two weeks prior to the term starting A second program allows students to charge to their UMR I D. card without a deposit of cash. Bookstore charges are incorporated with University fees and compiled into one monthly billing Financial aid or scholarship money can be applied to reduce charges The Campus Outreach program is designed to reach out to determine the needs of the campus, build relationships, goodwill, and business and

monitor service levels. The bookstore maintains a web site to post an event calendar, define policy statements, order merchandise on-line an provide feedback to management.

UMR Dining Service

The University Dining Services are contracted to and managed by Sodexho Marriott Services. It manages all manual food service operations on campus. These include the residence hall cafeterias at TJ and the Quad complex. It also includes the cafeteria and deli in the University Center. Catering activities are based out of the University Center. Although most catering f nctions are held in the University Center, they also provide service across the campus and in Rolla, supporting student and faculty programs and activities.

The **Minority Engineering Program** of the School of Engineering is designed to help students from minority groups academically, socially, and financially while enrolled at UMR. Academic and personal support is available and students are assisted in obtaining financial aid, summer employment, and coop positions. The program begins with a summer session at UMR in which students receive instruction at their level of achievement in mathematics, chemistry, and English.

UNIVERSITY ADVANCEMENT

Alumni Affairs and Development

The Alumni Affairs and Development office maintains a computerized database containing correct names and addresses of alumni, parents, and friends of the university, keeps these groups aware of events at UMR through an extensive program of publication, helps organize and staff such events as homecoming, reunions, and parents meetings; and conducts an active direct-mail fund-raising campaign.

The office also solicits gifts to the university from alumni, friends, corporations with ties to UMR, and philanthropic organizations.

The office also coordinates the meetings of the regional alumni groups and provides university speakers as appropriate.

Capital Campaign Update

The goals of the university's first major capital campaign — "The Full Circle Campaign" — are to provide competitive scholarship aid to incoming students, to provide badly needed support to departments, and to give some stability to long-range plans that will require nurturing.

The campaign has the goal of raising $60 million by June of 2001. As of the end of 1998, almost $49 million had been raised.

UMR's reputation for high-quality programs is the key to continued strong private fund raising. In 1997 the University of Missouri-Rolla embarked on its first major campus-wide fund-raising campaign — the "Full Circle Campaign". The campaign, which is planned to reach $60 million by June 2001, will provide funds for student scholarships and for faculty and program enrichment. Almost half of the money raised will go to the UMR endowment fund, where the effect will be felt far into the future in terms of providing UMR with the ability to attract the best faculty and student body and provide backing and facilities that will help them achieve their potential.

CAMPUS SERVICES

Institutional support is provided primarily by the Administrative Services Division. Units reporting to the Vice Chancellor for Administrative Services are Accounting/Fiscal Services, Human Resource Services, Physical Facilities, Purchasing, University Police, Environmental Management Services, Occupational Health and Safety Services, Telecommunications, Centralized Printing and Mail Service, and the Faculty Staff Assistance Program.

The **Accounting/Fiscal Services Office** provides assistance to the campus in the areas of accounting, cashiering, sponsored programs administration, and student loan collections. The specific services provided are detailed in the following comments:

1. Accounting handles the processing of all accounting-related documents, maintains the financial accounting and accounts payable systems, creates new campus accounts, pursues collection on miscellaneous accounts receivable, and provides a wide variety of assistance in response to campus requests for information and reports.
2. The Cashier's office supervises the cash-handling activities of the campus, including student fee billing and collection of student accounts receivable
3. The student loan collections office provides pre-loan counseling, maintenance of the student loan system, student loan exit interviews, and performs student loan collection activities.
4. Externally Sponsored Programs monitors post-award financial activity in the campus research accounts and assists principal investigators in the preparation of grant and contract proposal budgets

Human Resource Services operates in five major areas. 1) Recruitment activities are directed at finding qualified job applicants. 2) Salary and wage administration is concerned with job design and anal'sis so that employees can be hired and retained at an affordable price. 3) Staff benefit assistance is provided to employees to help them meet their medical, dental, and retirement nee.'s. 4) The training and development function is designed to improve the knowledge, abilities, attitudes, and performance of employees. 5) Labor relations activities concern negotiations with organized groups of employees on such matters as compensation, working conditions, and job security.

The **Purchasing Department** is responsible for procuring materials, supplies, equipment, and services as requested by the various campus departments and for processing payments associated with these purchases. Additional areas of responsibility include responsibility for the capital equipment inventory, dispositioning of campus surplus property, and operation of the campus supply center (storeroom).

The **University Police Department** provides a safe and secure environment for the educational process. The functions performed in satisfaction of this purpose include every

service offered by a law enforcement agency in a small city, as well as certain service functions specific to the university setting. The University Police Department also administers the parking regulations and lots for the campus, a perpetual source of discontent among faculty, staff, and students.

Environmental Management Services has two areas of responsibility: hazardous materials and radiation safety. Some activities include hazardous waste handling and identification and elimination of hazards. Occupational Health and Safety Services provides occupational safety and risk management. Some of the activities conducted by the office are emergency preparedness, an eye protection program, fire safety training, occupational safety and industrial hygiene, and worker's compensation.

Printing and Mail Services is responsible for the production and duplication of printed materials and some electronic documents for the campus and for the mail handling operation on campus. The print shop can provide typesetting, layouts, press work, bindery work, and quick copy services. About 80% of the printing required is done on campus This office also offers web page creation and design services and document-to-CD ROM services. The mail services include pick up and delivery of incoming and outgoing U.S. mail. Outgoing mail is weighed and postage is affixed before it is delivered to the U.S. Post Office. The department also provides complete bulk mail service, labeling, intercampus and intracampus mail delivery and pickup service for the campus.

Physical Facilities' role is large and diverse. The department is responsible for maintaining utilities (electricity, steam, water, chilled water, compressed air, as well as sewer and storm drains); maintenance of buildings and grounds; minor construction and renovation; custodial services; engineering and estimation for all campus departments; vehicle fleet maintenance; preparation of the annual Campus Capital Request, and assisting in administration of capital expenditures involving physical plant preservation, handicapped facilitation, safety, and energy conservation. Physical Facilities also sets up and dismantles whatever is required for the many special events that occur throughout the year.

Staff Development

Staff development programs are coordinated through the Human Resource Services Office in conjunction with the Center for Personal and Professional Development, the Safety and Risk Management Office, and the Computer Center. Every two years a "Needs Analysis" questionnaire is sent to campus staff members to help determine the types of classes of interest. Courses are also evaluated for content and appropriateness at the time they are presented. In some cases the campus has been unable to provide requested courses due to budgetary constraints.

The programs offered are training sessions in the form of classroom instruction, educational assistance, adult education, and

self-instruction. The two main categories of programs that are offered are job skills and personal development.

Management skills presented have included effective communication, performance evaluation, and time management.

The Faculty-Staff Assistance Program was established to provide psychological services for UMR's employees and their families. The program was originally aimed at problem employees — those whose personal problems were severe enough to adversely affect job performance. The program has evolved to include more proactive preventive activities providing employees with information, access to problem solving resources, and skill development opportunities. These support services provided by the Center for Personal and Professional Development help employees deal more effectively deal with life's demands and avoid problems that might otherwise adversely affect job performance and personal wellbeing.

FACULTY DEVELOPMENT

UMR provides services for faculty development by means of leaves of absence, support for participation in professional meetings, research initiation grants, and an awards program. Leaves of absence are granted to members of the faculty for institutional purposes. Leaves of absence provide opportunities for the reflection, research, and professional development essential in a scholarly community. Three types of leaves are available:

Sabbatical Leaves. All regular faculty members are eligible for consideration for sabbatical leave after six or more years of service at the University. Faculty members on sabbatical receive one-half their regular salary for up to one year and must state their intention to return to the University for at least one year upon completion of the leave.

Research Leave. Regular faculty members with established scholarly, artistic, or research records are eligible to apply for research leave. Faculty members are encouraged to seek outside support; however, the University may either supplement the funding or provide full salary for up to one year. Faculty members must state their intention to return to the University for at least one year upon completion of the leave

Development Leave. All regular faculty members are eligible to apply for leave to pursue personal, professional, instructional, or administrative development. The leave may be for up to one year at full salary, with outside funding obtained if possible. Faculty members must state their intention to return to the University for at least one year upon completion of the leave.

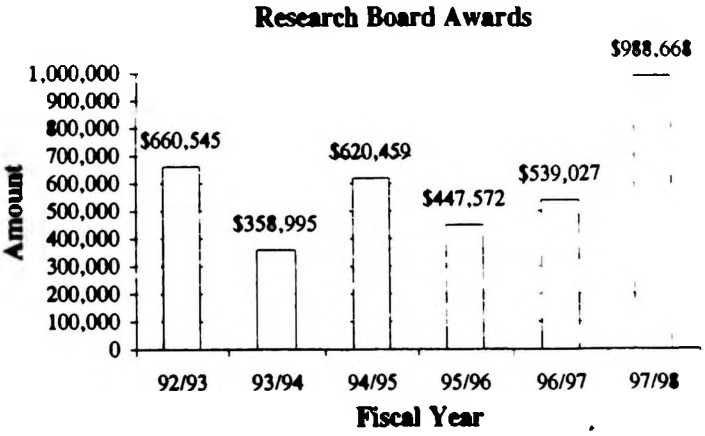


Figure 16

Faculty Research Support

Depending on school/college policy, a portion of grant release funds may be returned for the use of the principal investigator. The University of Missouri also provides funding for research projects through the University of Missouri Research Board awards in two competitive cycles each year. In fiscal year 1998, UMR received over $988,000 in Research Board awards. Over the life of the program, UMR has received over $3.6 million.

The Awards Program includes awards for outstanding teaching, outstanding advising, and faculty excellence. In 1968 the Board of Curators established a category of academic appointment called the Curators Professorship These prestigious positions are awarded to outstanding scholars with established reputations and provide a salary supplement and funds for equipment, travel, and graduate

student support. In 1990, the Board of Curators established a category of academic appointment called the Distinguished Teaching Professorship. These prestigious positions are awarded to outstanding teachers with established reputations and provide a salary supplement and funds for equipment, travel, and graduate student support.

The newest award — Woman of the Year — was established in 1997 to honor a female faculty member who serves as a role model on campus by achievements in her professional field, by commitment to student learning, support for diversity, respect for individual achievement and differing viewpoints, and willingness to speak out on issues that affect the quality of women's lives at UMR.

Mission Enhancement

The mission enhancement process is anticipated to extend over five years and increase significantly the state resources flowing to UMR. Campus priorities, established throughout the planning processes described above, include infrastructure engineering, manufacturing engineering, materials, geotechnical engineering, environmental engineering and science, leadership initiatives, and instructional technology. The decision has been made to use the initial two years of mission enhancement funding to add faculty positions in the enhancement areas. In fiscal year 1999, $1,665,000 in mission enhancement was allocated to support the following areas: information engineering ($500,00), manufacturing engineering ($500,000) and the cooperative degree program in engineering management ($665,000). Additional funds for our targeted areas are expected in fiscal year 2000.

The State of Missouri, as part of mission enhancement, has established a matching fund for endowed chairs and professorships. Essentially, the fiscal impact of a $550,000 donation to establish a named professorship is doubled by annual state support of the professorship equal to that produced by the private donation. Effectively, the $550,000 private donation produced income equal to a $1,100,000 endowment. Similarly, the effective impact of $1,100,000 donated to establish an endowed chair is doubled. This state program, in combination with the Full Circle capital campaign has led to the establishment of nine such endowed professorships with resultant impact on the quality of the faculty.

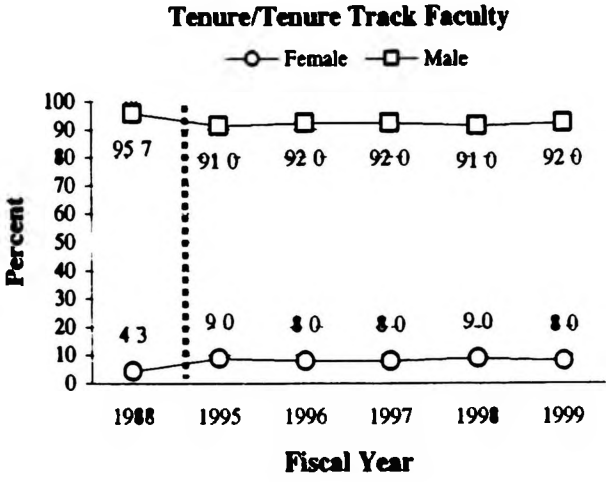
Academic Appointments

UMR is an Equal Opportunity Institution and completely supports and actively pursues the concept of affirmative action.

When the need arises to make an appointment to an academic position, a request is made by the department chair and, if approved by the dean, forwarded to the Office of Academic Affairs for approval by the Vice Chancellor. Approval provides authority to begin a search.

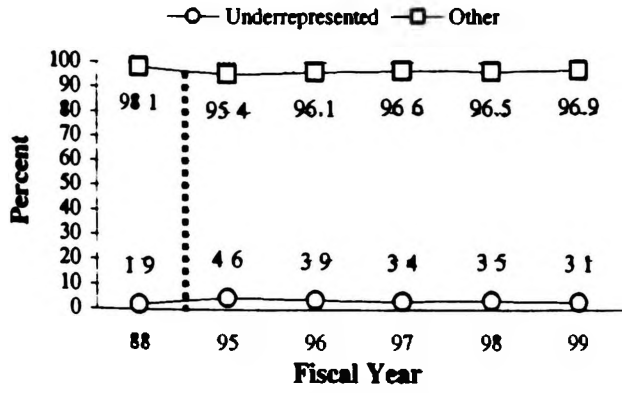
Advertising is done with definite effort to reach female and minority audiences. Once the deadline for application passes, candidates for

interview are selected, interviews are conducted, and a selection made. At this point, compliance with affirmative action guidelines is reviewed by the Assistant to the Chancellor for Affirmative Action/Equal Opportunity and, if approved, the department chair is authorized to offer employment.



Excludes Administrative Appointments

Figure 17.



Excludes Administrative Appointments
Underrepresented = African American, Hispanic, and American Indian/Alaskan Native

Figure 18.

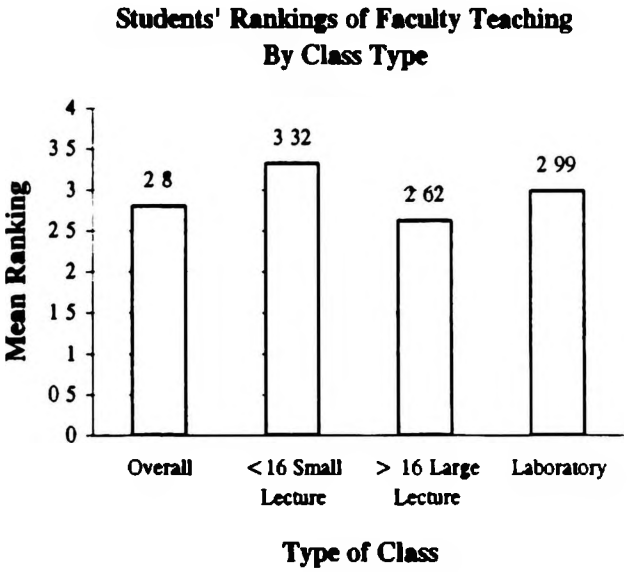


Figure 19.

PHYSICAL RESOURCES

Current real property holdings of the University of Missouri- Rolla can be categorized as follows:

Category I, land and facilities managed with general operating funds, considered to be the main campus;

Category II, land and facilities managed with general operating funds, but located some distance off campus; and

Category III, land and facilities managed with auxiliary funds located on or adjacent to the main campus.

Category I includes 59 buildings containing 1,525,426 gross square feet, located on 159.52 acres of land. Facilities and land in this category require intensive maintenance. Category II includes four buildings containing 5,159 gross square feet and 325.5 acres of land. Minimum maintenance is performed in this category. Category III includes 21 buildings containing 507,142 gross square feet, located on 85.17 acres of land. Facilities and land in this category require intensive maintenance. The replacement cost of all plant holdings is valued at $303,958,807.

Castleman Hall became operational in 1991. It serves as UMR's performing arts facility, as an acoustically superb performance hall, as an auditorium and houses UMR's Music programs as well as Alumni Affairs and Development

A number of temporary buildings on campus have fulfilled their usefulness and have been razed and programs assigned to more modern facilities.

A detailed master plan that illustrates present and planned use of the UMR campus and adjacent city areas is available for inspection.

Over the past ten years steady progress has been made in enhancing the physical resources of the campus. Four new buildings and additions — the Campus Support Facility, Castleman Hall, a major addition to the Emerson Electric Company Hall, the electrical engineering building, and an addition to the Gale Bullman Multi-Purpose Building — have been completed. In addition, there have been many other accomplishments, including completion of the hazardous chemical storage building, development of computer laboratories and the video classroom complex, ongoing handicap access projects, and acquisition of a complex of buildings from the U.S. Bureau of Mines which has closed its operations in Rolla which were located in several buildings proximate to the UMR campus.

Renovation of the Curtis Laws Wilson Library and the historic Rolla Building have also been completed within the last two years. In 1987, campus equipment was valued at $26,445,385, compared to a value of $43,568,699 in 1998. (These figures are for acquisition cost, undepreciated, and do not include items costing less than $1,000.)

The change in physical property over the past decade is shown in Table II.

Table II. Physical Properties

Value*	June 30, 1987	June 30, 1998
Land	$ 2,616,511 42	$ 4,173 520 20
Building and Improvements	75,017,687 41	110,948,652 51
Equipment	26 445,385 19	43 568,699 31
Library Books	5 517 869 42	12 515,221 88
Construction in Progress	1,236,902 69	4 415,188 36
Total Physical Properties	$110,834,356 13	$175,621,281 26
Construction in Planning	-------	$ 34,849 000

*Dollar value is acquisition cost

Planning for the Future

The expected needs of the campus are reviewed periodically to update planning. As of 1998, UMR's buildings totaled 1,313,062 assignable square feet and a renovation of and addition to the Butler-Carlton civil engineering department has received initial state funding The equipment inventory included recent acquisitions of state-of-the-art computing equipment, modern research instrumentation, engineering undergraduate laboratory equipment, and telecommunications equipment.

Although the quality of UMR's programs cannot be measured solely by expenditures for equipment, replacement of obsolete laboratory and classroom equipment is essential in maintaining currency, particularly in dynamically evolving disciplines. In this respect it has been particularly helpful to have had support from the Engineering Equipment Bill, passed by the Missouri Legislature which has generated over $7 million since FY87.

FINANCIAL RESOURCES

Because of varying limitations placed on the use of monies provided to colleges and universities by donors, grantors, and other resource providers, a specialized type of accounting called fund accounting is used in higher education In analyzing UMR's financial condition, attention is focused on four kinds of funds: current funds, plant funds, loan funds, and endowments.

Current funds are revenues and expenditures for operating purposes. These revenues, which total over $104 million in FY98, come from state-appropriated tax revenues, student fees, sale of services such as room and board through auxiliary services, federal and state grants and contracts, private gifts, grants and contracts, and other miscellaneous sources. Current fund expenditures include direct expenditures for instruction, research, auxiliary services, institutional support (which includes development, financial services), academic support (e.g., library, academic administration), operation of the physical plant, scholarship and fellowship support, student services (counseling, health services), and public service activities. Tables III and IV show how these current fund revenues and expenditure patterns have changed since 1980

The most significant change has been the growth of tuition and fees (both in dollars and as a percent of our current fund revenue) and the proportionate drop in state appropriations as a percent of revenue. This is the result of the large fee increases that were a part of the university five-year plan (in effect from FY93 through FY97) and the moderate growth in state appropriations. On the expenditure side, a large share of the fee increase was offset by the increase in scholarships and fellowships from unrestricted funds. This unrestricted funded aid has allowed the campus to improve the quality of incoming students (as measured by ACT and high school rank) but has reduced net fee revenue.

Other changes in revenue and expenditure patterns have not been as dramatic as the change in fees and scholarships. As a percent of the expenditure base, the primary missions of instruction, research, and public service are stable. The modest fluctuations in the support areas are due in part to changes in the classification of computing expenditures The auxiliary area has decreased as a percent of current fund activity because these operations are dependent on mostly student generated income. Over this period, the on-campus enrollment has dropped over 16%

Declining enrollment has imposed, and will continue to impose for at least the next four years, severe constraints upon the current operating budget. While the campus has been successful in attracting more highly qualified students over the past several years, it has not been able to attract enough. The current on-campus student population is well below the carrying capacity of the physical and human resources. The campus leadership has made student recruitment and retention its highest

Table III.

CURRENT FUND REVENUES & EXPENDITURES (Dollars in Millions)

	FY 80	FY 85	FY 90	FY 95	FY 96	FY 97	FY 98
REVENUE							
Tuition & Fees	6 5	$14 2	$15 0	$28 2	$31 4	$33 2	$32 6
State Appropriations	18 8	23 7	34 0	37 1	38 8	40 9	41 9
Federal Grants & Contracts	3 4	5 1	5 2	6 9	6 9	6 8	7 4
State Grants & Contracts	0 2	0 3	0 8	0 9	0 8	1 0	0 5
Private Gifts, Grants & Contracts	2 0	4 4	5 2	7 6	8 9	8 6	9 2
Recovery of Indirect Costs	1 0	1 4	1 5	2 2	2 7	2 4	2 4
End wment Income	0 1	0 3	0 6	0 9	1 1	1 1	1 3
Investment Income	0 2	0 7	0 3	0 2	0 2	0 3	0 3
Sales & Services of Educational A tivities	0 0	0 0	0 1	0 3	0 3	0 3	0 3
Sales & Services of Auxiliary Enterprises	3 9	5 9	4 4	5 6	5 4	5 7	5 8
Other Sources	0 2	0 4	0 7	1 1	1 0	1 7	1 9
Inter-Campus Transfers(In Invest Inc prior to FY87)				0 7	0 6	0 6	1 0
TOTAL CURRENT FUND REVENUE	$36 3	$56 4	$67 8	$91 7	$98 1	$102 6	$104 6
EDUCATIONAL & GENERAL EXPENDITURES & TRANSFERS							
Instruction	$13 3	$20 9	$26 5	$34 3	$36 8	$37 6	$38 4
Research	4 6	7 2	10 0	15 3	14 3	14 7	15 6
Public Service	0 5	0 7	1 1	2 0	3 0	3 1	3 2
Academic Support	3 1	4 7	4 1	4 7	5 5	4 5	6 4
Student Services	2 0	3 2	4 5	6 1	6 5	6 6	6 8
Institutional Support	2 9	3 7	5 1	5 5	6 1	6 4	6 6
Operation & Maintenance of Plant	3 1	4 7	5 5	5 8	6 3	8 0	8 2
Scholarships & Fellowships	1 1	3 5	4 8	9 1	10 4	11 6	12 3
Mandatory & Non Mandatory Transfers	0 5	0 7	1 3	0 2	1 6	2 0	1 2
SUBTOTAL E&G EXPENSE & TRANSFERS	$31 1	$49 3	$62 9	$83 0	$90 5	$94 5	$98 7
Auxiliary Enterprises Expenditures & Transfers	4 2	6 7	5 2	6 9	6 5	6 6	6 7
TOTAL EXPENSE & TRANSFERS	$35 3	$56 0	$68 1	$89 9	$97 0	$101 1	$105 4
Excess (Deficit) of Restricted Rcpts Over Trans to Rev	($0 1)	($0 3)	$0 5	$0 5	($0 3)	$0 8	$0 4
Net Increase (Decrease) in Fund Balance	$0 9	$0 1	$0 2	$2 3	$0 9	$2 3	($0 4)
Fund Balance at Beginning of Year	$3 8	$6 1	$9 8	$13 9	$16 2	$17 1	$19 4
Fund Balance at End of Year	$4 7	$6 2	$10 0	$16 2	$17 1	$19 4	$19 0

Table III (continued)

CURRENT FUND REVENUES & EXPENDITURES (AS A PERCENT OF TOTAL)

	FY 80	FY 85	FY 90	FY 95	FY 96	FY97	FY98
REVENUE							
Tuition & Fees	18%	25%	22%	31%	32%	32%	31%
State Appropriations	52%	42%	50%	41%	40%	40%	40%
Federal Grants & Contracts	9%	9%	8%	8%	7%	7%	7%
State Grants & Contracts	1%	1%	1%	1%	1%	1%	1%
Private Gifts, Grants & Contracts	6%	8%	8%	8%	9%	8%	9%
Recovery of Indirect Costs	3%	2%	2%	2%	2%	2%	2%
Endowment Income	0%	1%	1%	1%	1%	1%	1%
Investment Income	1%	1%	0%	0%	0%	0%	0%
Sales & Services of Educational Activities	0%	0%	0%	0%	0%	0%	0%
Sales & Services of Auxiliary Enterprises	11%	10%	7%	6%	6%	6%	6%
Other Sources	1%	1%	1%	1%	1%	2%	2%
Inter-Campus Transfers	0%	0%	0%	1%	1%	1%	1%
TOTAL CURRENT FUND REVENUE	102%	100%	100%	100%	100%	100%	100%
EDUCATIONAL & GENERAL EXPENDITURES & TRANSFERS							
Instruction	38%	37%	38%	38%	38%	37%	36%
Research	13%	13%	15%	17%	15%	15%	15%
Public Service	1%	1%	2%	2%	3%	3%	3%
Academic Support	9%	9%	6%	5%	5%	4%	6%
Student Services	6%	6%	7%	7%	7%	7%	7%
Institutional Support	8%	7%	7%	6%	6%	6%	6%
Operation & Maintenance of Plant	9%	8%	8%	7%	6%	8%	8%
Scholarships & Fellowships	3%	6%	7%	10%	11%	11%	12%
Mandatory & Non Mandatory Transfers	1%	1%	2%	0%	2%	2%	1%
SUBTOTAL E&G EXPENSE & TRANSFERS	88%	88%	92%	92%	93%	93%	94%
Auxiliary Enterprises Expenditures & Transfers	12%	12%	8%	8%	7%	7%	6%
TOTAL EXPENSE & TRANSFERS	100%	100%	100%	100%	100%	100%	100%

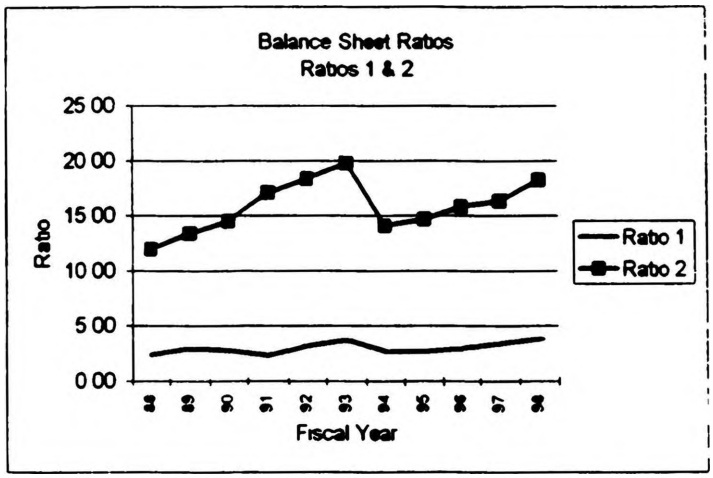
Table IV.

BALANCE SHEET RATIOS

(comments from Ratio Analysis in Higher Eduction - Second Edition Peat Marwick Mitchell & Co)

Ratio 1 **Expendable Fund Balances / Plant Debt**
A ratio of 1 1 or greater indicates sufficient liquid assets to satisfy all related liabilities
Anything greater than 1 is considered strong

Ratio 2 **Net Investment in Plant / Plant Debt**
A measure of potential liquid assets which is important if Ratio 1 is substantially below 1 1
Anything greater than 3 is considered strong



Ratio 3 **Expendable Fund Balances / Total Expenditure & Mandatory Transfers**
The trend of this ratio is most important Expendable fund balances should increase at least in proportion to the rate of growth of operating size
Between 25 and 5 is considered acceptable

Ratio 4 **Nonspendable Fund Balances / Total Expenditures & Mandatory Transfers**
The higher the value of Ratio 4 the more favorable the institution's financial condition A declining trend in this ratio might signal a weakening financial condition
Less than 3 is considered weak

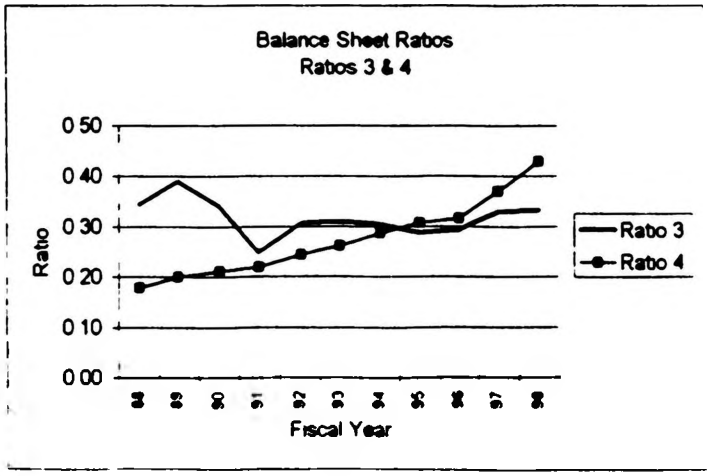


Table IV (continued)

NET OPERATING RATIOS

(comments from Ratio Analysis in Higher Eduction - Second Edition, Peat, Marwick Mitchell & Co)

Ratio 5 Net Total Revenues / Total Revenues

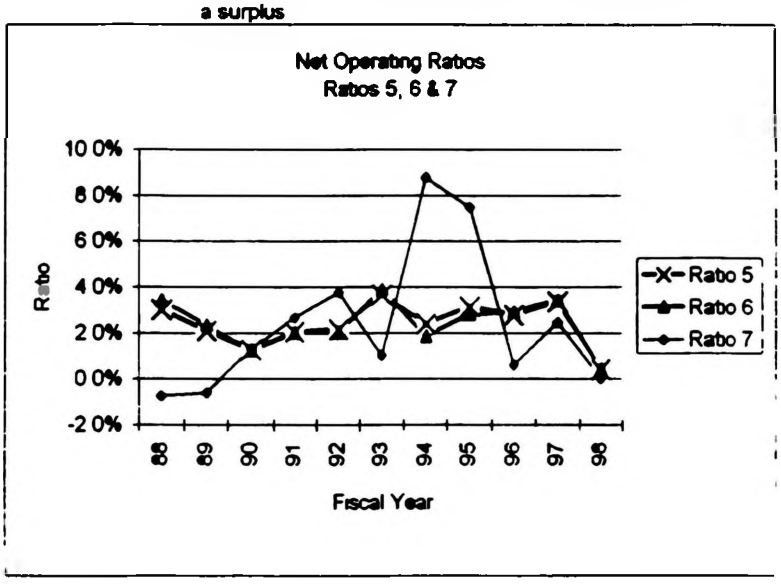
This ratio indicates whether total current operations resulted in a surplus or deficit. A positive ratio indicates a surplus for the year

Ratio 6 Net Educational & General Revenue / Total Educational & General Revenue

This ratio indicates whether education & general operations resulted in a surplus or deficit. A positive ratio indicates a surplus for the year

Ratio 7 Net Auxiliary Enterprise Revenue / Total Auxiliary Enterprise Revenue

This ratio indicates whether auxiliary enterprise operations resulted in a surplus or a deficit. A positive ratio indicates a surplus for the year. It is not unusual for auxiliary operations to fluctuate between a deficit and a surplus



priority and is reassessing its priorities in student financial aid awards.

UMR's market position for research funds depends almost exclusively on the quality of faculty research and the priority with which such funds are pursued. he trend of sponsored research expenditures has been one of growth over the last 20 years. The continued importance of engineering and applied science research to the nation's economic competitiveness suggests that the opportunity for such funds will continue to be good. The campus is endeavoring to enhance the overall level of research support. Increased support for research equipment is an especially important prerequisite for increased success in generating external research support. The campus recognizes that grant writing support is needed for humanities and social sciences faculty In addition to strengthening the campus' research program, additional grant and contract activity would help to expand graduate enrollment by providing additional support for graduate research assistants

Gifts to the campus have increased substantially in the past ten years. Among other things, this support has helped to partially finance new buildings on the campus and to expand scholarship support for students. Private funds come to the university from two primary sources corporations and alumni. Corporate support most often results because a company employs UMR graduates and wishes to encourage strong programs on the campus. Alumni contributions result largely from the loyalty and affection individual alumni have for the campus. While there has been a gratifying increase in support over the past few years, there is every reason to believe that this support can continue to grow with careful nurturing and effort.

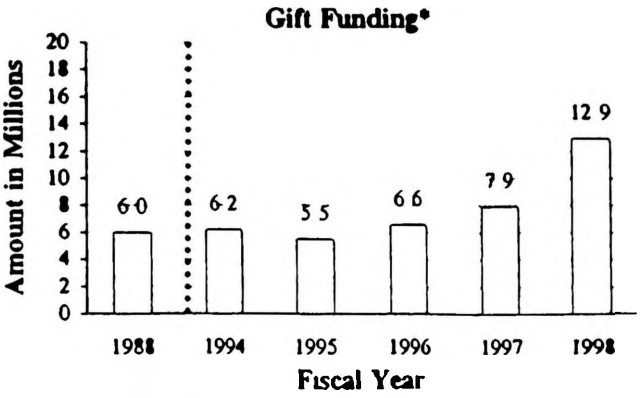


Figure 20

Plant funds refer to the permanent physical assets of the University and, as the balance sheet data show, the net investment in plant has grown from $102 million in FY87 to over $167 million in FY98.

Because of the different guidelines, student loan funds administered by UMR are divided into U.S Government Loan programs (Perkins) and others. As the balance sheet data show, the U.S. Government Loan programs fund balance has grown only modestly in the past decade. However, there have been substantial increases in the Ford Loan Program not reflected in the university fund balances. In addition, the university has increased its own loan programs dramatically. These programs have a more attractive repayment and interest schedule. The increases in these programs

have been possible through the generosity of alumni and friends of the university and the directed use of unrestricted university funds. The use of unrestricted funds for loans is an attempt to relieve the strain of the increasing scholarship and fellowship expenditures described previously Even with these additional funds there are still unsupported qualified student loan applicants

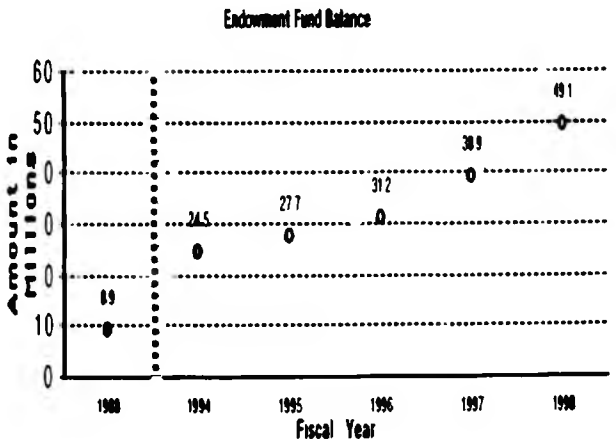


Figure 21

Endowment funds are those monies that are to be invested, with only the income available for expenditure for institutional purposes. The income from these endowment funds is used to support faculty, students, and a variety of essential campus programs. UMR's endowment has grown over the past ten years from $6 3 million to $49 1 million Comparisons with other public institutions make clear that this is nonetheless a rather small endowment.

To help assess UMR's overall financial condition, the well-established Ratio Analysis method designed by Peat, Marwick, Mitchell, and Company for institutions of higher education was employed. Four balance sheet ratios and three net generating ratios have been calculated for use in assessing financial condition. A copy of the resulting analysis is included as Appendix A. The conclusions drawn are that UMR is indeed financially healthy, it is generally better off financially today than it was ten years ago, and is living within its means. The concern for the next few years will be to maintain our financial health with the targeted student body size, quality, and diversity.

In summary, although there is always a need for more funds for operating and capital purposes, UMR's financial affairs are being managed prudently and the institution is living within its means. The great financial challenge for UMR lies in finding the resources to achieve a level of national competitiveness that will allow it to fulfill its mission on behalf of the state and nation.

ACADEMIC PROGRAMS

Teaching Quality and Performance of Students

UMR uses two chief measures of student achievement: 1) the traditional devices of tests, grades, curriculum requirements, placement records, program reviews, alumni feedback, and campus attitudes; and 2) the eleven-year-old University-wide campus assessment programs which utilize a wide range of tests and surveys including freshman entry ACT scores (or comparable test scores), the Academic Profile Test measure of general education achievement for rising juniors, and a senior departmental and/or standardized assessment exam. Surveys of students' views are administered to incoming freshmen to shape orientation and other programming. Satisfaction with many aspects of students' in- and out-of-class experiences is assessed toward the end of the freshman year, at the time students sit for the APT (sophomore-junior nexus), and immediately following graduation for fall graduates each year. Taken together, these approaches to assessing student academic achievement and satisfaction provide the campus with an accurate but limited portrait of its strengths and weaknesses and its successes and failures. The campus is also informed by surveys seeking employer satisfaction with UMR engineering graduates. These surveys show a high level of satisfaction. There are rarely complaints about scientific and technological preparation. However, there are occasional concerns expressed about the interpersonal skills, leadership abilities and teamwork capabilities of our graduates. The most serious concerns about interpersonal and leadership skills are expressed by recent alumni, who rate these as their weakest, but perhaps most important, areas of development. A major mission enhancement effort in student leadership is presently being developed and the campus is already stressing leadership experiences through the UMR Promise Program described below.

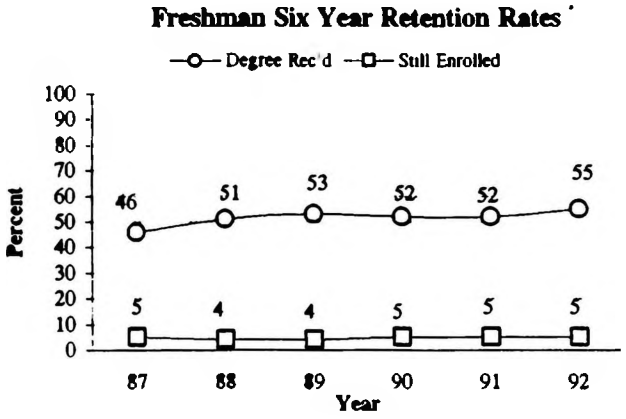


Figure 22

UMR begins its quest for quality in student achievement by attracting first-class students. As an institution known for providing excellent undergraduate education in engineering and the sciences, with parallel quality programs in the liberal arts, the campus has a reputation of rigorous academic programs. This reputation draws talented students who have achieved high rank on national tests and/or in their high school class standings — an average entering fall 1998

freshman ACT test score of 28.0, highest of any public institution in the state (UMR's out-of-state freshmen had an ACT average of 28.8). Fifty-one percent of the fall 1998 freshmen were from the upper 10% of their class. This high reputation results in a self-selective admissions pattern: prospective students are aware that students at UMR are a high caliber group with backgrounds and abilities which rank them at the top of entering freshman classes at public colleges and universities in the state of Missouri.

Beginning with the Fall semester 1997, freshmen entering the University of Missouri system, were required to have 14 units of credit that include:

- 4 units of English, one of which may be in speech or debate. Two units emphasizing composition or writing skills are required. (Previous requirement was 3 units of English.)
- 4 units of mathematics; algebra I and higher. (Previous requirement was 2 units.)
- 3 units of science, not including general science and including one laboratory course (Previous requirement was 1 unit.)
- 3 units of social studies
- 2 units single foreign language
- 1 unit fine art

In addition to the increase in the units of credit required for incoming freshmen, the sum of the student's high school rank percentile and aptitude examination percentile must meet the UM admissions requirement of 120 or greater. UMR's admissions office cautions prospective freshmen that the total percentile rank of the ACT scores and high school rank of a typical successful student should exceed 120. UMR asks for and receives bright students, a first criterion for success in achieving the educational goals of the institution. About 95% of the entering freshmen do meet this recommended profile.

Once students are enrolled, their academic performance is evaluated with semester grade reports and referrals for those failing to maintain grade point averages at or near the 2.0 level. The exact grade point average required to maintain progress in various programs is given in the Student Academic Manual. The students' transcripts serve as a permanent record of their academic success or difficulties.

During the 1986-87 academic year the campus began a pilot assessment program designed to include another nationally-normed set of measures of student achievement at UMR. This pilot program has expanded to a permanent process of evaluation of nearly every student and each campus program. Students entering their junior year now take the Academic Profile Test (APT), devised to measure their knowledge of general education material. There were a few years in which the University of Missouri mandated the use of a different evaluation instrument, CBASE (developed at the University of Missouri-Columbia), and this has resulted in an interruption in the APT data available for

assessment. Academic departments administer discipline-based examinations to their graduating seniors. In addition, a wide range of surveys and other test instruments are administered. These assessment instruments provide additional indications of strengths and weaknesses in our academic offerings and inform curricular revisions.

Beyond the boundaries of the campus, student achievement is measured with national tests such as the Graduate Record Examination and the Fundamentals of Engineering Examination. Because many students major in engineering disciplines, career placement records are used to determine their success in finding employment and their comparative starting salaries. Through the Alumni/Development office, information is collected detailing graduates' career tracks, satisfaction with their campus experiences, and their overall attitudes about the campus and its programs. Although job placement information is fragmentary, data we received from graduates indicate that their starting salaries are in line with national averages and documented placement rates are high.

These many measures of student achievement have served the campus well in determining whether we are succeeding. On the Graduate Record Examination UMR graduates perform above the mean in verbal and analytical aptitude and in the engineering subject test, and well above the mean in quantitative aptitude. Likewise, on the Fundamentals of Engineering Examination, UMR's "passed" rate is quite good although it has declined since many of the academic departments have made the exam mandatory, without student accountability for the results. This is an area of assessment which needs to be strengthened.

Employers actively seek UMR graduates. Over the past ten years an average of 300 companies have annually interviewed prospective engineering and science candidates through the Carer Opportunities Center. These companies have conducted an average of five thousand interviews a year during the past decade. Very few of our graduates seeking employment fail to find a satisfactory position within six months of graduation. However, attracting companies to interview liberal arts graduates has been difficult.

UMR Promise

For many years, the primary objective of an engineering education has been simply to establish technical competency — the ability to get the job done. The "energy crisis of 1973" and the development of global competition brought about a slight broadening of that objective, such that technical competency became getting the job done in an energy-efficient and cost-minimizing manner.

In 1994, a Boeing Corporation white Paper defined the "Attributes of an Attractive Engineering Graduate" with the eight points described in the attached listing. Points one and two affirm the desirability of technical competency. However, points three and four add increased emphasis to humanities and

social sciences and the various communication skill areas Finally, points five through eight describe qualities acquired through personal development and lifelong learning.

Very similar conclusions were reached in "Engineering Education for a Changing World" by the Engineering Deans Council and the Corporate Roundtable of the American Society of Engineering Education (ASEE) in 1994. The conclusions of this report (known as the "Green" report) fed directly into the desired characteristics of engineering education found in ABET's Engineering Criteria 2000.

A 1996 survey conducted by the National Association of Colleges and Employers asked employers of engineers to rate fifty skills on a one to five scale where a five would be "most important" or "required for employment" and a one would be "least important" or "not required" Surprisingly, "proficiency in field of study" ranked eighth in importance behind such items as: oral communication skills, interpersonal skills, teamwork skills, analytical skills, flexibility, leadership skills, and written communication skills. Surveys of UMR alumni and employers of our graduates further confirmed this assessment. The 1998 survey presents a similar pattern.

Desired Attributes of an Engineer
The Boeing Company
July 1996

- A good understanding of engineering science fundamentals
  - Mathematics (including statistics)
  - Physical and life sciences
  - Information technology (far more than "computer literacy")
- A good understanding of design and manufacturing processes (i.e., understands engineering)
- Possesses a multidisciplinary, *systems* perspective
- A basic understanding of the context in which engineering is practiced
  - Economics, including business practices
  - History
  - the Environment
  - Customer and societal needs
- Good communicator
  - Written, Verbal, Graphic, and Listening
- High ethical standards
- An ability to think both critically and creatively — independently and cooperatively
- Flexibility — An ability and the self confidence to adapt to rapid/major change
- Curiosity and a desire to learn for life
- A profound understanding of the importance of teamwork

Many of the most desired traits were best classed as acquired skills rather than taught knowledge. In fact, an assessment by numerous individuals concluded that development of the desired "package" of skills and knowledge would require the coordination of both classroom instruction and co-curricular involvements throughout the college experience. While co-curricular opportunities were indeed numerous (student council; fraternity, sorority, and residence hall organizations; professional societies; activity-based clubs, and

others) and we could all cite examples of students who had utilized them effectively, it was apparent that we really had little control of student life with the exception of the academic curriculum

The Promise Professional Plan, while often viewed as the campus' guarantee of a quality education, is actually designed to motivate students to follow a balanced program of intellectual, social, and professional development designed to meet the "new" and broader objectives of an engineering education. To be eligible to "claim the promise", students must maintain a minimum grade point average while simultaneously pursuing a planned program of co-curricular involvement which is documented in a university-monitored co-curricular transcript, which documents involvements and accomplishments outside the instructional curriculum. The specific requirements of the program are designed to address the objectives of personal development, teamwork skills, leadership skills, communication skills, and career management skills. As a result, UMR students are encouraged to view their education as a combination of classroom learning and all of the other involvements and experiences associated with their college years. The same attention and planning that traditionally was applied to curriculum and course selection are now applied to the entire educational experience.

Job Outlook '98

(Survey of the National Association of Colleges and Employers)

Top features employers are looking for: (5 = most important; 1 = least important)

Interpersonal skills	4.7
Teamwork skills	4.6
Analytical skills	4.5
Oral communication skills	4.5
Flexibility	4.5
Computer skills	4.3
Written communication skills	4.1
Leadership skills	4.1
Work experience	4.1

Numerous other, less precise, indicators suggest that UMR is succeeding in performing its mission. Among these are the above-average level of alumni support, the comments of alumni when surveyed, the achievements of UMR students in regional and national competitions, and the very strong evaluations of UMR graduates by their employers.

Along with these strengths of student achievement, we have found some weaknesses in our programs. Along with many other colleges and universities in the nation, UMR is concerned about the writing and oral communication skills as well as the critical thinking abilities of our students. An Oral Communications Center and Writing Center have been developed to improve student communication skills. The Writing Across the Curriculum Program, which fosters the development of

writing-emphasized and writing-intensive courses in all disciplines, is one of the initiatives undertaken to improve students' performance in communication and critical thinking. As the campus assessment program is implemented more fully, possible weaknesses as well as strengths will become apparent.

In addition to the Promise Professional Plan, the Center for Personal and Professional Development is working collaboratively with other departments to create leadership development programs. Mission enhancement funds have been targeted for development in this area. A Corporate Leadership Development Program will enable students to further develop their communication, leadership, and personal skills so they can move into corporate leadership positions at an accelerated pace. A Scholar Development Program is designed for students who wish to pursue research as an undergraduate while preparing for graduate programs of distinction.

ROTC. UMR is known nationally for the outstanding quality of its Army and Air Force ROTC units and for the high percentage of cadets commissioned. The campus has both Army and Air Force cadres.

Overall however, the devices used to measure student achievement continue to indicate that this campus attracts very able students who perform well by campus and national measures. UMR graduates are respected throughout the country, and our programs have a reputation for rigor and high standards. Based on the evaluations cited above, we believe we are succeeding in the mission to provide a quality undergraduate education for students in all fields on campus.

Academic Curricula Degree Program

A listing of all degrees which UMR currently grants is given in Appendix V. The detailed requirements for each undergraduate degree are given in the undergraduate catalog. Requirements for graduate degrees are more variable, but the basic guidelines are presented in the graduate catalog.

Bachelor of Arts Degree Program. The Departments of Economics, English, History/Political Science, Philosophy, and Psychology confer the B.A. degree. The general requirement for a bachelor of arts degree is 120 credit hours, and a 2.0 minimum grade point average. Detailed requirements are given in the undergraduate catalog.

Bachelor of Science Degree Program. In the College of Arts and Sciences, a minimum of 130 credit hours is required for a bachelor of science degree. Only the Biological Science, Economics, Management Systems, and Psychology departments give credit for algebra and trigonometry as part of the 130-hour total. Each science curriculum in the College of Arts and Sciences requires a minimum of 21 hours of humanities and/or social science credit.

For the bachelor of science degree in the schools of Engineering and Mines and Metallurgy, a minimum of 132 credit hours is required. Each engineering curriculum contains a minimum of one-half year, or 16

hours, of humanities and/or social science courses as previously specified by the Engineering Accreditation Commission (EAC) of the Accreditation Board for Engineering and Technology (ABET). Also, in keeping with prior ABET requirements, each student is required to take some advanced level courses in the humanities and/or social sciences to ensure that both breadth and depth are obtained in these areas.

While the College of Arts and Sciences and the Schools of Engineering and Mines and Metallurgy all require a 2.0 grade point average for the bachelor of science degree, the Schools of Engineering and Mines and Metallurgy also require that a minimum of 2.0 grade points per credit hour is obtained in all courses taken in the student's major department.

Beginning this year, UMR — in cooperation with the Missouri Department of Elementary and Secondary Education (DESE) — has offered its own certification program. The Education Program is organized to offer courses of study approved by the DESE that will qualify graduates for teacher certification. Practical field experiences include action research, observation, demonstration, and participation in local school settings. Students who prepare for a teaching career must meet general education and professional education requirements specified by the Missouri Department of Elementary and Secondary Education and the program requirements of the University of Missouri-Rolla

Dual Bachelor's Degree. UMR also has a Dual Bachelor's Degree program that allows a student to earn baccalaureate degrees in any two fields. The amount of additional credit required for the second baccalaureate degree is based on the student's educational background and is determined by the academic department which offers the curriculum leading to the second degree. The chair of the department will submit a list of the specific courses and credit hour requirements (totaling at least 30 semester hours), together with the student's transcript, to the dean of the school/college, for approval. This list is then forwarded to the registrar and constitutes the official requirements for the second degree.

Course Maintenance. Perhaps the most difficult task confronting the faculty at UMR is that of keeping the curriculum current with the rapid changes occurring in the disciplines represented on the campus. Toward this end, the faculty makes numerous changes in the curricula each year. These changes include creation of new courses, deletion of old courses, and changes in details such as degree requirements, course numbers, prerequisites, catalog descriptions, and course titles. These changes are reviewed by curriculum committees and approved by the Academic Council.

To carry out its mission and purpose, the University of Missouri-Rolla must have quality academic programs which include the disciplines of campus focus as well as those parallel programs that provide the essential

general education component of all quality academic endeavors. Furthermore, additional learning experiences which enrich the student's education must be available. This institution is constantly reviewing its programs and learning experiences to ensure that they are assisting the campus in carrying out its mission and purposes.

Each academic program of the campus is reviewed at least once every five years as a requirement of the Missouri Coordinating Board for Higher Education. This review process was begun in 1984, and all UMR academic programs have been reviewed to date (see Appendix IV for review schedule). Each review includes a description of the program, a discussion of the opportunities for improvement, an assessment of the competitive standing of the program, and a collection of numerical data that summarizes the instructional and research activity of the program and its budgetary resources. Engineering departments undergo review by the Accreditation Board for Engineering and Technology at least every six years.

Curricular Opportunities

Although this campus does not have a multitude of exotic degree programs, we are able to assist students in their pursuit of foundation studies for a wide range of professions/careers A number of degree programs have emphasis areas, for instance, 'environmental' in geological or civil engineering or biological sciences; or a block of 'business-related' courses can be grafted onto most any degree program to better position a student for careers in that realm.

We have existing advisory arrangements for pre-professional interests in law, medicine, and education specialities.

Another valuable tool is the variety of scheduled minor programs that offer a student the chance of filling intellectual interest needs while earning applied degrees or, that permit BA students to link applied subject emphasis to their liberal arts core. Minors are granted in such areas as film study, foreign languages, technical writing, communication studies, sociology, accounting, and finance as well as all the disciplines with baccalaureates in the College of Arts and Sciences. Many highly qualified enrollees are attracted to the intellectual stimulation of disciplines other than their major.

Special Programs. In recent years additions and improvements have been made in the area of institutional services to improve the quality of student life. These include honors programs for both freshman and upper class students, the Freshman Engineering Program, the College of Arts and Sciences ASSIST program, the mentor program, and the supplemental instruction program. These programs are designed to meet the campus's commitment to quality educational experiences for all students.

Early in the decade the campus initiated a supplemental learning program called EXCEL Workshops composed of groups of three to seven students meet twice a week outside class

to teach and learn from each other at an enrichment level and enjoy a different approach to learning the material. An upper class facilitator trained in team-building and cooperative learning methods, and who has successfully experienced the course, leads the group. Generally, Excel workshops are available in the core mathematics and general science courses each semester.

In addition to the learning opportunities, Excel provides students with the chance to develop their skills in communication, facilitation, organization–leadership.

The Intensive English Program (IEP), established in 1994, provides instruction in the English language for international students to help them attain a level of proficiency that will allow them to be successful in college-level work at UMR. Extensive testing by the IEP faculty is used for placement and progress. Help is also available for international students already admitted to UMR.

In 1995 a program was created to attract prospects for graduate study as well as the 'best and brightest'. It is styled the Master Student Fellowship Program (MSFP) with eligibility based on 99th percentile national test scores and top 10 percent class rank. (It is assumed that most qualified students will have over a semester's worth of advanced placement credits upon matriculation) The student is offered incentives to complete baccalaureate and masters degrees in five years of study. The institution commits to undergraduate research opportunities and a seamless transition to graduate study.

The response has been both troublesome and rewarding. Over 350 students have enrolled in the four years since its inception Graduate departments have wrestled with accommodating anticipated stipends, and faculty mentors have been hard pressed to fill the needs for research supervision. On the other hand, some departments have reveled in the occasion to place their highly talented undergraduates in foremost graduate programs upon completion of bachelor's degrees.

For many years the General Honors program was an opportunity for highly capabl entering students to take courses at an intensive level (especially as related to writing requirements for the course). If 15 credit hours of such designated courses were earned and the GPA was 3.5 or better, the students were recognized as having graduated with "General Honors". Another option was for a student who qualified by virtue of grades to do a senior thesis project — generally as part of a capstone/design course for graduating seniors — and earn distinction as an "Honors Graduate".

With the advent of the MSFP in FS95 there was some ambiguity regarding the honors program. For one thing, it was assumed that there were a number of highly qualified students who might be honors students who were not MSFP students. It became evident in 1997 that a redesigned honors program was in

order, especially since over two hundred students each fall were eligible for and enrolled in the honors seminars.

As of FS98, and available to students from the prior two fall entering freshmen cohorts, honors is incorporated under the identifier Honors Academy Fellow. Eligible participants — 95th or above percentile ACT or SAT score, in top 10% class ranking; 3.5 GPA transfer grades — enroll in an Honors Seminar during their initial year with the objective of ingraining an 'honors habit'. Thereafter, they are to arrange for 12 credit hours of course work within and without their major discipline as 'honors' and cap the program with a senior thesis project that includes an oral presentation of their work. Successful completion of the honors designated course block and a 3.5 GPA earns the recognition Honors Academy Fellow on their permanent record.

In the School of Engineering, honors projects are done on an individual basis with faculty members Students who complete an honors project are listed in the commencement program as "Honors Scholars in Engineering".

Academic Enhancement Centers (AEC's) have been established in each residence hall complex and in the Southwestern bell Cultural Center. The AEC's are intended to assist students in achieving academic success The assistance is provided by paraprofessional staff and student peers and assesses and strengthens study skills through focusing on time management and study methods

Writing Across the Curriculum In 1993, the UMR faculty passed a revised general Education Requirement that included the provision that each department would provide students with opportunities to develop communication skills by taking at least two writing-intensive and/or written and oral communication courses, with at least one writing-intensive course in the major, and proposed the establishment of a Center for Writing Technologies to support students and faculty in this endeavor. A new faculty position in the English Department as WAC Coordinator/Writing Center Director was filled in 1996 The Center for Writing Technologies was opened in 1997, providing classroom space dedicated to writing, tutor training, and peer tutoring for undergraduates and hosting writing workshops and tutorials for students and faculty. An interdisciplinary Communication Across the Curriculum Implementation Committee began the process of certifying and assessing writing emphasized courses in departments across the university as the first phase of developing the mandated writing-intensive courses.

The **Department of Basic Engineering** was organized during the summer of 1988 to provide a focal point for quality teaching and advising of underclass engineering students The department is responsible for the successful Freshman Engineering Program as well as all engineering graphics instruction and instruction in fundamental engineering mechanics (statics, dynamics, mechanics of

materials, materials testing) The faculty consists of twelve full-time teaching faculty, three of whom are associated with engineering graphics instruction. In addition, the School of Mines and Metallurgy provides one FTE of teaching support The department is not a degree-granting unit but, through the Freshman Engineering Program, advises approximately 850 students annually. The permanently assigned faculty perform only a part of this advising. The remaining advising is provided by faculty of the engineering degree-granting departments assigned to the Freshman Engineering Program on a part-time basis.

The **Freshman Engineering Program** was established in 1986-87 The purpose of the program is to provide all incoming freshman with an overview of the various types of engineering and to provide high quality academic advising in order to maximize the potential of the students. The academic advising is accomplished by faculty members from the engineering departments in the School of Engineering and the School of Mines and Metallurgy. Other faculty members are available to discuss each engineering specialty and career opportunities in that specialty During the first semester, students take the course "Introduction to Engineering", which is designed to acquaint them with the opportunities available in engineering fields and with the resources available on campus that can assist in making career decisions During the second semester, students take "Introduction to Careers" which provides more information on the engineering career fields available at UMR Students may apply for admission to a specific engineering department upon completion of a prescribed set of courses Particular features of the UMR Freshman Engineering Program which distinguish it from other programs are: advising by engineering faculty; an early warning system that alerts advisors when a student is having difficulty in a particular course; and training for advisors in career development and making use of the professional services on campus. Student evaluations have given the program high marks, indicating a high level of satisfaction.

The **ASSIST Program** (Arts and Sciences Students in Scholastic Training) is the program of the College of Arts and Sciences to meet the academic and nonacademic needs of students in the College. The ASSIST program is a system whereby instructors report students with low test grades or excessive absences so that they may be called in to discuss problems that they may be having. This process identifies students who are beginning to have academic or nonacademic problems and helps prevent their being placed on probation. These students may be referred to such campus services as tutoring sessions or the Center for Personal and Professional Development Future plans include an improved primary advising system, supplemental instruction, and an A&S Mentor/Tutor Program.

Regional Professional Development Center (RPDC). In 1994, the Department of Elementary and Secondary

Education established nine centers around the state for assisting certified teachers and school systems with professional development of their staff and institutions. UMR received a center with responsibility for the territory of South Central Missouri. The center provides programs that reflect the technological nature of the campus as well as an intended focus on content-specific workshops, short courses, and credit courses contained in campus disciplines. The Center gives UMR an opportunity to serve the broader educational needs of this area of the state.

Graduate Programs

The University of Missouri-Rolla offers graduate programs in 19 departments or areas. On-campus graduate student enrollment was 640 in Fall 1998.

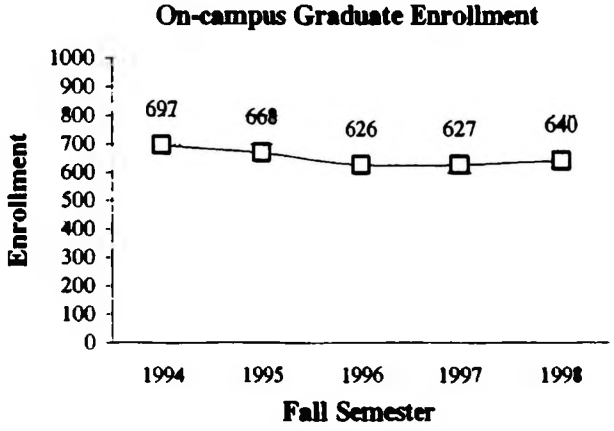


Figure 23.

Graduate study at UMR involves advanced work in engineering and the sciences, with research serving as an integral part of the program. Research activities are carried out in department laboratories and special facilities on and off campus. UMR offers master of science, doctor of philosophy, and doctor of engineering degrees. Studies fall into the general areas of engineering and science.

The master of science degree is available in aerospace engineering, applied mathematics, ceramic engineering, chemical engineering, chemistry, civil engineering, computer engineering, computer science, electrical engineering, engineering management, engineering mechanics, environmental and planning engineering, geological engineering, geology and geophysics, mechanical engineering, metallurgical engineering, mining engineering, nuclear engineering, petroleum engineering, and physics.

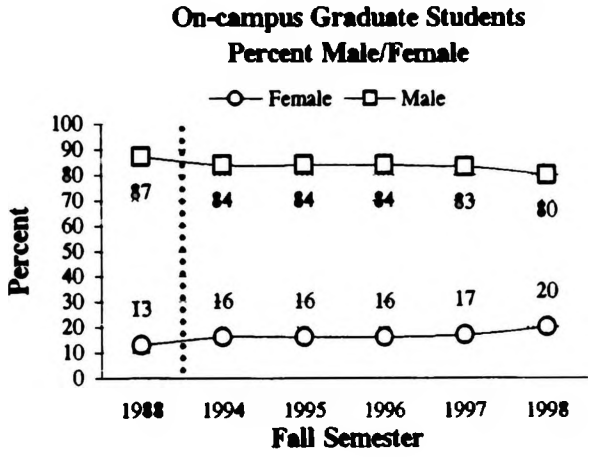


Figure 24.

The master of science for teachers degree is available.

The doctor of philosophy degree is available in ceramic engineering, chemical engineering, chemistry, civil engineering, computer engineering, computer science, electrical engineering, engineering management, engineering mechanics, geological engineering, geology and geophysics, mathematics, mechanical engineering,

metallurgical engineering, mining engineering, nuclear engineering, petroleum engineering, and physics.

The doctor of engineering degree is available in ceramic engineering, chemical engineering, civil engineering, electrical engineering, geological engineering, mechanical engineering, mining engineering, nuclear engineering, and petroleum engineering

The Departments of English and History have entered into cooperative agreements with their respective departments at the University of Missouri-St. Louis to offer Master of Arts degrees. A maximum of twelve graduate semester hours may be taken at UMR (with no more than nine credit hours at the 300 level). Although the Coordinating Board of Higher Education encouraged such agremeents, arrangements have been difficult to work out.

Admission as a regular graduate student requires a B average in the last two undergraduate years or standing in the upper one-third of the baccalaureate graduating class The Graduate Record Examination may be required by some departments and is mandatory for all international students.

A person not desiring a graduate degree or not eligible for admission as a regular graduate student can be admitted by the director of admissions with approval of the school/college dean. Such persons are designated as special graduate students Any special graduate student who subsequently desires to become a candidate for a degree may be admitted to regular graduate standing upon recommendation of the department chair in the proposed major field of study and approval of the school/college dean. However, such consideration is not permitted until the student has completed a minimum of 12 semester hours of graduate coursework with a cumulative grade point average of 3.00 or higher. Only that portion of the work completed as a special graduate student which is approved by the student's adviser, department chair, and school/college dean may be applied toward a graduate degree, but all work completed as a special graduate student — as well as GRE scores — will be considered relative to admission to degree candidacy.

In addition to satisfactory GRE scores, international students are required to demonstrate sufficient command of English to pursue, with profit, work at UMR. The Applied Language Institute, operating under the aegis of International Affairs and the Department of English, provides an intensive English program for students needing additional language instruction before they are ready for regular academic activities.

The Center for Writing Technologies designates tutors with advanced writing skills to help graduate students with theses, dissertations, and other graduate program writing projects.

Scholastic Requirements. In order for a graduate degree to be granted, the cumulative grade point average must be 3.00 or better on all graduate work taken at UMR, as well as for all courses in the program of study.

In cases where a graduate student repeats a course, both the original and repeat grades will be used in calculating the average grade point and will appear on the record.

A graduate student accumulating ten or more credit hours of C and F grades shall no longer be a candidate for an advanced degree from this institution.

Graduate Student Instructional Communication. Since the fall of 1986, all graduate students who are seeking appointment as Graduate Teaching Assistants have been required to attend an Instructional Communication Workshop before the start of their first semester In the workshop the prospective GTA prepares and presents a short (10 min.) presentation or lesson in his/her field, suitable for an introductory undergraduate course. The student also participates in a simulated discussion with a student. The presentation is videotaped and evaluated for organization, content, and delivery. Those students who get a grade of B+ or higher may be appointed. Those who have a grade of B or lower may be appointed as graders but must take communication courses and be reevaluated before being appointed as GTA's. In addition, international students must achieve a grade of at least 570 on the Test of English as a Foreign Language (TOEFL), or 220 on the TSE/ SPEAK exam.

The workshop requirement was instituted in response to concerns expressed by undergraduates that some of their instructors were difficult to understand and did not understand questions. The faculty recognize that the ability to communicate professionally is essential for all academic professionals. Indeed, UMR's Academic Council has supported an English proficiency program. UMR has established a web location from which a student concerned about the English proficiency of an instructor (whether faculty or graduate student) can send a message directly to the Vice Chancellor for Academic Affairs. The Vice Chancellor reviews complaints and brings significant concerns to the appropriate dean and department chair. These individuals will work with the instructor to find a way to remediate the difficulties. Students are informed that their identities are stripped from the messages before they are forwarded to the Vice Chancellor but that their identities will be determined in the event they send offensive or other inappropriate messages. The system was begun in the fall of 1998

Faculty

The success of an educational institution depends heavily upon the quality of its faculty. The faculty teach the students, lead and conduct the research, and carry out the service and outreach activities that comprise the mission of a modern land grant research university. UMR has a highly qualified, well-recognized, hard-working faculty. Significant fiscal efforts have been made to increase their compensation over the last decade and the campus has come close to achieving parity with the public institutions in the AAU. Maintaining this competitiveness

is a high priority and will ensure that the campus continues to improve the quality of its academic enterprise

A number of criteria are used to evaluate the quality of faculty members in performance of their various functions. One measure of faculty research quality is that of the funded research dollars attracted to the campus by the faculty members. Another measure is the number of books, chapters in books, and journal articles published by scholarly presses. Particularly considering UMR's traditional concentration on undergraduate education, the faculty does an admirable job of attracting outside support for research and instruction

Faculty quality in teaching is an elusive quantity to attempt to measure: perhaps the best overall measurement can be performed in terms of "customer satisfaction" — the grade that a student would give to each of his or her professors in an overall evaluation of the professor's teaching performance. In the latest available evaluation (1996-97), the overall average rating on campus was 2.8 on a 4.00 scale Teachers of small lecture classes (<16) averaged 3.32, of large lecture classes (>50) averaged 2 62, and teachers of laboratory courses averaged 2 99.

Faculty Performance Reviews are conducted annually by each faculty member's department chair. Faculty activity reports, completed by each faculty member and forwarded to the dean, are the basis for the review The reviews evaluate overall performance during the previous year, set realistic performance goals for the following year, and when apropriate, assess progress toward tenure. The results of the review are forwarded to the Dean's level The university administration and the curators have delegated to the four campuses decisions on promotion and tenure of faculty members.

The University recognizes outstanding faculty performance in a number of ways (besides increased compensation). Approximately 20 effective-teaching awards are made each year based upon the results of student evaluations of teachers as described above About 15 monetary awards are presented each year as Faculty Excellence Awards based on faculty members' performance in all areas of the University's mission.

The Curators of the University of Missouri have chosen a select group of faculty members as Curators Professors. These individuals were selected on the basis of outstanding national and international reputations in their respective fields. UMR has been successful in justifying the granting of one Curators' Professorship each year. In addition to the honor bestowed, there is a continuing financial commitment to the recipient's research work. Fifteen faculty members at UMR have been selected for this honor. The campus also has seven Distinguished Teaching Professors who are selected on the basis of nominations recognizing outstanding effective teaching, ongoing scholarship, and significant service to the university

Research

Research is an integral part of the programs of the University of Missouri-Rolla, and is a major component of the campus mission. The commitment to research is reflected in hiring practices and in promotion and tenure guidelines. In 1997 faculty members published 499 articles in refereed journals and proceedings in addition to theses, dissertations, books, conference proceedings, and other contributions. Approximately 83 undergraduate students are awarded research grants annually under the OURE program. For a significant number (106 of 221) of the students earning the masters degree on campus, research is a key ingredient in their program. Information on the research interests of individual faculty members is contained in the Graduate Catalog.

Departments

The **Biological Sciences** Department offers the B.S. degree and anticipates initiating a graduate program. Active areas of research include heavy metal toxicity, biologic implants, plant genetics, and immunochemistry.

The **Ceramic Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees. The department specializes in research concerning the structure of vitreous materials as implied from properties such as infrared absorption, internal friction, and refraction index. Crystalline structure, orientation effects, constitution of glass color, radiation effects, infrared materials, electrical resistivity, ferro-electric behavior, thermal shock, composites, and vaporization and phase equilibria are all areas of ongoing research.

The **Chemical Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees. The department specializes in research in the areas of rheology, fluid mechanics, freeze drying, reaction engineering, bioengineering, physical property measurements, water desalination, membrane technology, turbulence theory, instrumentation and control, thermodynamics, kinetics of reactions, conversion of biomass into energy and chemicals, computer-aided design, surface phenomena, polymers, and electrochemistry The latter two programs are carried out in cooperation with the Graduate Center for Materials Research. Many aspects of the research mentioned have facets appropriate to environmental and energy conservation research.

The **Chemistry** Department offers the Master of Science and Doctor of Philosophy degrees. The department provides instructional programs in the fields of analytical, inorganic, organic, physical, and biochemistry as well as in more specialized areas of chemistry There are active research programs in each of the basic fields as well as programs in colloid, environmental, nuclear, polymer, surface chemistry, surface coatings, theoretical, and cosmo-chemistry. Interdisciplinary programs in materials science, atmospheric science, and water resources are also available to chemistry

students. The Paint and Coatings Program is one of four such research programs in the nation

The **Civil Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees Among the areas of research emphasis in the department are. study of micropollutants in water, water runoff and infiltration, river mechanics (potamology), soil stabilization and consolidation, model analysis, dynamic studies of structural materials, earthquake structural analysis, cold-formed steel structures, coordinated traffic studies, and urban planning.

The **Computer Science** Department offers the Master of Science and Doctor of Philosophy degrees. Active research in the department includes projects in the areas of operations research, numerical analysis, robotics, artificial intelligence, automated reasoning, and languages.

The **Economics** Department offers B.A. and B.S. degrees and conducts research in econometrics energy and regulatory economics, environmental, international, and labor economics, risk and uncertainty, forensic economics, and economic pedagogy.

The **Electrical and Computer Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees in electrical engineering and computer engineering. Areas of active research include circuits, communications, computer engineering, control, electromagnetics, physical electronics, power distribution, smart structures, structural health monitoring, electromagnetic comptibility, variable speed drives, power system dynamics, battery energy storage systems, solid state materials, electro-optics, optical computing, communications and digital signal processing, image processing, VLSI design, embedded computers, automated manufacturing, power system reliability, and electronics.

The **Engineering Management** Department offers the Master of Science and Doctor of Philosophy degrees. Areas of special emphasis in research within the department include management of technology, industrial marketing, integrated manufacturing, production, packaging engineering, and system reliability and logistics.

The Department of **English** offers the B.A. degree and a cooperative M.A. degree with the University of Missouri-St. Louis. the department specializes in research in literature and science, rhetorical theory and the discourse of public policy-making, women writers and editors in science fiction, contemporary American literature, Irish-American literature, composition theory, science writing and travel literature, literature and film, autobiographical elements in Shakespeare, British fiction and medical science, and adaptations of Middle Eastern and Asian poetic forms.

The **Geological Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees Special areas of research

emphasis include physical and hydraulic properties of rock, weak rock and soil, subsurface fluid flow, and remote sensing.

The **Geology and Geophysics** Department offers the Master of Science and Doctor of Philosophy degrees. Research areas include mineralogy, petrology/petrography, geochemistry, and remote sensing.

The Department of **History and Political Science** offers the B.A. degree and a cooperative M.A. degree with the University of Missouri-St. Louis. The department specializes in research in colonial America, Missouri, technology, civilizational theories, modern Europe, American politics and diplomacy, Africa, and political philosophy and theory

The **Management Systems** Department offers B.S. degree. Research interests are in those interdisciplinary areas of usability design and testing involving investigators from engineering management, computer science, economics, and psychology.

The **Mathematics and Statistics** Department offers the Master of Science and Doctor of Philosophy degrees. Active ongoing research areas include ordinary and partial differential equations, reliability theory, functional and classical analysis, algebra, number theory, and probability.

The Department of **Mechanical and Aerospace Engineering and Engineering Mechanics** offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees Research areas include acoustics, robotics, heat and mass transfer, various types of flows, elasticity, plasticity, experimental stress analysis, vibrations, shock wave propagation, structural dynamics, composite materials, and computational mechanics.

The **Metallurgical Engineering** Department offers the Master of Science and Doctor of Philosophy degrees. Research efforts in the department include thermodynamics and kinetics of pyrometallurgical and electrometallurgical processes, surface property modification by ion implantation, mineral separation processes, heat treatment of steels, and recovery of metals from metallurgical wastes.

The **Mining Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees. Research areas include rock mechanics, explosives, mine operations and ventilation, coal preparation, and mining economics.

The **Nuclear Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees. Research areas include reactor design and safety, risk assessment, thermal hydraulics, radiation transport, nuclear materials, and fusion.

The **Philosophy and Liberal Arts** Department offers the B.A degree and areas of emphasis for other degrees. Research interests include philosophy of religion, philosophy of science, environmental ethics, epistemology, origin of slang, Russian semantics, Amazonian

boats, Brazilian poetry, William Blake, Tom Benton, Tudor and Jacobean music, and English madrigals.

The **Petroleum Engineering** Department offers the Master of Science, Doctor of Philosophy, and Doctor of Engineering degrees. Special research emphasis is in reservoir mechanics, oil recovery, computer applications, and mathematical modeling of petroleum reservoirs

The **Physics** Department offers the Master of Science and Doctor of Philosophy degrees. Special research emphasis is in both experimental and theoretical aspects of physics of the solid state, atmospheric cloud physics, and atomic and molecular physics.

The Department of **Psychology** confers B.A. and B.S. degrees and pursues research in cognitive processes in technical education and written language production, human-computer interaction, social cognition, interpersonal relationships, and organizational psychology.

Research Centers, Contract Research, and Institutes

The University of Missouri-Rolla has eleven research centers and ten institutes which provide structure to focused interdisciplinary efforts Many graduate students pursue their research under the auspices of one of these centers or institutes In some instances the center or institute is aimed at serving as a catalyst for interaction between the university and business, industry, government, and individual citizens.

The **Center for Economic Education** promotes research in economic education and improves economic literacy in Missouri in part by developing programs that involve students and teachers at all levels in the investigation of real-world problems in industry, government, and households using economic tools and reasoning. The Center provides programs on economic education for business, industry, and interested citizens and is affiliated with eight other centers around the state, with the Missouri Council on Economic Education, and with the National Council on Economic Education (Economics America).

The **Intelligent Systems Center**, an interdisciplinary, multi-faceted Eminent Program on the UMR campus was established to assist Missouri-based companies in becoming more competitive in the world economy. Research in the areas of robotics, artificial intelligence, manufacturing, and materials processing is focused along four themes: Production Planning and Scheduling, Crisis Management, Risk Assessment/Decision Support, and Flexible Manufacturing Systems.

The **Graduate Center for Materials Research** was established in 1964 for the purpose of multidisciplinary research on materials and is one of the Eminent Programs of the University. The research conducted in the center ranges from fundamental science to applied engineering and includes development, evaluation, application, and understanding of the behavior of ceramics, metals, polymers, and composites.

The **Biochemical Processing Institute** promotes instruction and research in processes involving biochemical reactors, biochemical separations, and microbial and enzymatic technology. Bioseparation research includes the areas of freeze drying, affinity chromatography, ultrafiltration, membrane separations, adsorption, ion exchange, and gross protein separations. Research in enzyme technology includes isolation and purification of enzymes of commercial interest from microbial sources and the use of immobilized enzymes and microorganisms for the production of chemical feedstocks from biomass. Research studies are currently being conducted in cell cultivation and biomaterials.

The **Cloud and Aerosol Sciences Laboratory** has as its primary objective the investigation and laboratory simulation of the physical processes active in the formation and subsequent development of clouds. Sophisticated cloud chambers are used to investigate basic nucleation processes of water and the influence of pollutants and to enable a more effective theory to be constructed.

The **Rock Mechanics and Explosives Research Center** brings together leading investigators from different disciplines to research static and dynamic rock mechanics, and explosives technology. The High Pressure Waterjet Laboratory of the Center has developed a world-renowned team of waterjet technology specialists.

The **Center for Environmental Science and Technology** promotes and coordinates the interdisciplinary study of the relationship of human health to the environment. The program is multidisciplinary and involves areas of chemistry, life sciences, geology and geophysics, and civil engineering.

The **Generic Mineral Technology Center for Pyrometallurgy** conducts research in all areas of pyrometallurgy — smelting, refining, roasting, oxidation, plasma processing, computer modeling, and information systems. The Center is a joint effort with Purdue University, Ohio State University, and the Massachusetts Institute of Technology.

The **Institute of Applied Mathematics** brings together faculty members and students from the department of mathematics and statistics and other sciences and engineering to study applications of mathematics to a variety of scientific and technological problems.

The **Institute for Extractive Metallurgy** focuses the work of researchers in several disciplines on hydrometallurgy, electrometallurgy, and pyrometallurgy, with emphasis on metals produced in the region.

The **Institute of River Studies** focuses on comprehensive studies of the nation's natural waterways.

The **Institute of Surfactant Systems** builds on UMR's strength in colloid chemistry. Research is conducted into the molecular structure of surfactants and amphiphiles with the goal of practical uses.

The **Institute of Thin Film Processing Science** provides advanced graduate

education in thin film processing and serves as a focal point for ongoing research in films and film technology The Institute is part of the Graduate Center for Materials Research.

The **International Institute of River and Lake Systems** serves as a centralized database for worldwide river and lake data. UMR participates in the Institute with University College, Dublin; the University of Alexandria, Egypt; and Ruhr University, West Germany

The **Laboratory for Atomic and Molecular Research** provides a focus for UMR faculty members doing research on atomic and molecular structures and interactions. Laboratory participants have made significant contributions in areas of laser, accelerated beam, and nuclear fusion technology.

The **Missouri Mining and Mineral Resources Research Institute** supports either basic or practical research related to mineral resources, mining and mineral technology, mineral economics, and mineral conservation and reclamation.

The **Transportation Institute** conducts research in all forms of transportation — highways, railroads, waterways, airways, pipelines, and conveyors, as well as new, evolving forms

The **Experimental Mine**, a 25-acre surface and underground facility, includes several dolomite quarries. The underground workings consist of four shafts and 1,500 feet of single-level drifts. Recent faculty and student research has been conducted in the areas of rock blasting, mine ventilation and atmospheric control, and rock mechanics.

All centers and institutes are reviewed every five years.

Contract research, ranging from basic research to applied research aimed at a specific industry, annually provides a substantial portion of the university's operating budget. During 1997-98 faculty research activities resulted in $11 million in grant and contract expenditures to the campus. In the past 25 years, the University of Missouri-Rolla has moved from a largely undergraduate institution to a recognized member of the national and international research scene. The faculty includes several world-class researchers, with many others moving toward that level of accomplishment.

Outreach

The University of Missouri-Rolla began as a response to the Morrill land grant act of 1862 and thus has from the beginning assumed responsibility for state-wide education in "the mechanic arts".

Continuing Education. The UMR Extension Division was established on July 1, 1964, as part of the four-campus reorganization of the University of Missouri. This action formally supplied the third faculty function found in a land grant university — resident teaching, research, and extension. Nearly 7,700 Missourians participate annually in over 200 credit and non-credit courses.

Concurrent with the start of the Extension Division was the beginning of the UMR Engineering Education Center in St. Louis. The Center, offering evening courses for engineers and scientists in the St. Louis area, started with two M.S. programs. Today there are eleven M.S. programs (computer science and ten disciplines of engineering). In the last ten years, over 806 degrees have been awarded through the Center. The M.S. in Engineering Management is also offered at Fort Leonard Wood. Using the four-campus video system, courses are taught from Rolla to the Engineering Education Center, and it is planned to offer the M.S. in Engineering Management using this system across the state on Missouri in cooperation with five regional universities. The Department of Engineering Management is also involved in providing graduate courses for the National Technological University.

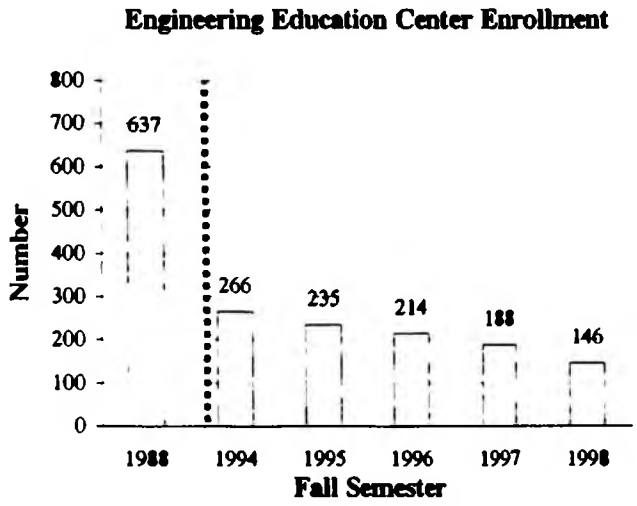


Figure 25.

The College of Arts and Sciences has an evening credit program for citizens within commuting distance of Rolla with an emphasis on courses for regional teachers. The College is cooperating with the UMSL School of Nursing in presenting a B.S.N. in the evening for local registered nurses. UMSL is teaching the nursing courses by video, and UMR is supplying the other courses for the degree with in-person teaching.

The non-credit program, tailored to fit the specific needs of the clientele, is considerably larger than the credit program. UMR has developed a national and international reputation in non-credit professional continuing education for engineers and scientists. Most of the short courses and conferences are held either in Rolla or St. Louis. In addition, in-house programs have been developed for industries in Missouri and outside the state.

Other non-credit activities include programs developed specifically for the community of Rolla and for use in the state of Missouri relative to career opportunities, music programs, and physical education activities. Arts and Sciences continues its strong and nationally known program in paints and coatings. The Department of Electrical and Computer Engineering has offered, for over 15 years, a very successful program in electromagnetic concepts including grounding and shielding.

Cooperative Extension

UMR has a cooperative extension program which supplies technical assistance and problem solving to small communities, elected and appointed officials, and small businesses of the state. Faculty expertise is

used from all three academic units of the campus For most technical assistance, UMR faculty work in cooperation with the state-wide extension field specialists. During 1987-88, this program expanded when the Chancellor requested and received University support for a Center for Technology Transfer and Economic Development

Significant federal and state funding makes possible a number of activities focused on the needs of Missouri industry. These include the Industrial Assessment Program (IAP) which subsidizes energy audits of small companies involving UMR faculty and students. IAP activities have resulted in significant efficiency improvements at a number of companies. The Missouri Research and Training Center (MRTC) channels over $500,000/year in state funding to support, in part, research supported by corporations with a presence in Missouri

The Small Business Development Center (SBDC), with both state and federal funding, is a source of technical and marketing information to small businesses.

Community Enrichment

In addition to regional and statewide extension activities, UMR plays an active role in the local community. For example, Castleman Hall serves as the focus of cultural activity for students, faculty, and staff and has the only auditorium of its size in Rolla and the nearby region, thus materially enhancing the intellectual and cultural life of the area. Area residents are welcome at UMR Film Series, Madrigal Dinners, band and choral concerts, the University Theater Series, and the Campus Performing Arts Series. The Remmers Lectures, sponsored by an alumnus, bring prominent lecturers and performers to Rolla; lecturers of note within the last five years include Margaret Thatcher, Collin Powell, and Bill Bradley.

An important local service provided by the campus is the public radio station, KUMR-FM. An affiliate of National Public Radio, KUMR-FM provides high quality public interest broadcasting 24 hours a day over a 70 mile radius from its transmitter south of Rolla. The station brings to the area a broad selection of NPR programming as well as quality locally produced programs, some of which are carried by other stations in the network. The program "We're Science" for example, is now carried by 143 public radio stations across the country. In 1997 KUMR enlarged its listening area by beginning translator service in Lebanon, Missouri.

UMR athletic teams provide intercollegiate competition in a broad range of men's and women's sports. In addition, there is a host of activities for area youth, adults, and the aging. Youth activities include physical fitness programs sponsored by the Physical Education and Recreation Department. Summer programs include Joe Miner Camp, basketball camps, and cheerleading camps. Physical fitness for adults includes a women's water exercise class, offered regularly during the academic year. In addition, a series of clinics and competitions

for area marching and concert bands is held annually.

For those community citizens who wish to hone their public speaking skills, "Effective Spoken English" is currently offered as a non-credit course.

UMR is the area center for the annual Science Fair, in which more than 150 ninth through twelfth graders from 15 surrounding counties are judged on the design of research projects. Winners of the local fair go on to state and national competitions.

MATHCOUNTS, another national program designed to encourage interest in mathematics and science, involves seventh and eighth graders in math competitions similar to spelling bees, in which teams and individuals can gain national recognition. UMR serves as the point of regional coordination for these events, which draw over 150 junior high students to the campus with their teachers/ coaches.

The History/Political Science Department coordinates the south-central region's annual "History Day", in which elementary and secondary school students prepare papers and projects in a competition to determine winners who will go on to state-wide and, ultimately, a national History Day competition.

The Rolla Writing Project provides in-service training for area teachers in all disciplines. The summer workshops and courses focus on improving student writing by improving the teaching of writing. The experience improves university and school relationships and enhances the professionalism of classroom teachers. The project is directed by faculty in the Department of English.

For those members of the community who require specific technical information, the expertise of UMR's faculty is available through individual consulting services. Moreover, technical non-credit courses and workshops are offered by UMR each semester.

Various student organizations, such as the Inter-Fraternity Council (IFC) and service fraternities, lend assistance to a variety of local charitable groups through fund-raisers, serve as volunteers, assist in local clean-up campaigns, and other community betterment activities. These student participants are a positive force in UMR's efforts to serve the community.

UMR serves Rolla and the surrounding communities, including Fort Leonard Wood, through credit and non-credit continuing education courses, community service extension activities, cultural and educational events, library and recreational facilities, and research primarily through the Missouri Research Assistance Act program. UMR also has a significant impact on the financial health of the community. In return, the communities provide UMR with financial and political support. These activities, both on the part of UMR and on the part of the community, certainly assist UMR in carrying out its mission of public service and aid UMR in meeting its financial obligation.

In terms of the campus's impact on the region, UMR is the only four-year institution of higher education within 70 miles of Rolla. In addition, UMR is the second largest employer and is a very important part of the region's economy. Members of UMR's faculty and staff and their spouses are active in the community in many ways, playing leading roles in the Chamber of Commerce, school boards, hospital boards, and churches. UMR faculty and staff members have been involved in various ways in more than 20 high technology businesses in the area.

In addition, the annual Jackling Institute brings high school students to UMR to explore possible engineering or science careers, as does the Introduction to Engineering program.

MAMTC

UMR coordinates one of the Missouri regional districts for the Mid-American Manufacturing and Technology centers, established to provide up-to-date technological advice to Missouri manufacturers. Over the past five years, more than $5 million, from the National Institutes of Standards and Technology (NIST) and the Missouri department of Economic Development, has come to the Rolla region. As the name suggests, the funding supports a professional staff which assists Missouri companies with improving their manufacturing technologies.

FUTURE DIRECTIONS

UMR has a history of commitment to engineering and science. The record of accomplishment over the past 128 years is a source of pride for everyone connected with the campus, and, indeed, all Missourians. UMR is viewed as the premier institution in the state in the education of undergraduate scientists and engineers. Its transformation to a research university is of more recent vintage and is continuing. It is seen as a source of technological assistance by the small business community and as the major source of engineers by the larger industries of the state.

The University of Missouri-Rolla is embarking on a systematic program of improvement designed to create a technological University of true national distinction. The areas to be emphasized are spelled out within the program review and mission enhancements plans which are available for review.

The strategy by which UMR intends to achieve its goals is based on strengths and traditions which are reflected in the state-wide image of the institution. There are three basic elements: 1) Ensure the continued national eminence of UMR's existing undergraduate programs, 2) Develop national eminence in selected areas of graduate education and research that are important to Missouri and the nation, and 3) Develop new programmatic initiatives that ensure UMR's continued service to Missouri and its eminence as a technical university

The strategy begins with UMR's greatest strength — quality undergraduate programs in science and engineering. To sustain this recognized strength will require additional investment and effort. After a century of more or less continuous growth, Missouri has been in an era of declining numbers of high school students statewide and resulting increased competition among universities for students In addition, the growing fraction of high school graduates made up of ethnic minorities is creating a more diverse student body. Nothing is more important to sustaining UMR's reputation for superior undergraduate programs than continued attraction of the most able young people.

To continue to compete successfully for these students, UMR must be capable of providing the environment that they seek. Several recent institutional changes address the issues of student recruitment and retention.

1) *The Master Student Fellow Program* began as a way to integrate the undergraduate and graduate experiences on the path from freshmen to master's degrees in engineering and science. It had been the experience of UMR's Admission Office that highly capable students had some exposure to research emphasis in high school or summer activities and they were interested in intensifying that in their university education. The Master Student Fellow program was designed to offer that emphasis. In the three years of its

existence, the program has involved 238 students and over one hundred are expected to enroll in the program as freshmen in the fall of 1998. Persistence in the program has been very high. Seventy-six percent of the original group of freshmen who entered in the fall of 1995 are still in the program. Further, eighty-seven percent if this original group are still enrolled at UMR. Fifty-four of the original group have attained senior status by Fall 1998 and they will have to decide whether to continue on as graduate students at UMR. The percent that continue will be a final measure of the overall success of the program.

2) *For Instructional Improvement*: Establishment of the Freshman Engineering Program for better advisement, the College of Arts and Sciences ASSIST Program for retention purposes, the Basic Engineering Department for improved instruction of basic engineering courses, the faculty and graduate teaching assistants workshop for improvement of classroom instruction, the Institutional Assessment Program for better data on program effectiveness, the Missouri-London Program for study abroad opportunities, the Honors Program for enriched learning, and the Writing Across the Curriculum Program supported by the Center for Writing Technologies to improve written communication, all illustrate the campus commitment to its mission of quality instruction. In addition, the recent engineering equipment bill passed by the Legislature has permitted purchase of up-to-date equipment, two new academic buildings add significantly to the learning environment, and student/faculty ratios in electrical, mechanical, and aerospace engineering have been improved through the addition of faculty members.

3) *For Enhanced Affirmative Action and Equal Employment Opportunity*: New initiatives, such as the cooperative effort with Penn Valley and the St. Louis Community College district, and corporate scholarship and coop agreements to support minority students are underway. In the future, commitment of resources to hire minority faculty members, an increased recruiting effort directed toward female students, the establishment of a spousal hiring policy, and efforts to hire more women faculty members will be steps toward fulfilling UMR's mission in this area. Both Emerson Electric and Sprint are supporting these efforts.

Reinforcement of the importance of superior undergraduate teaching will be an important means of sustaining the eminence of the undergraduate program. There is evidence of increased attention to efforts on the campus to improve teaching effectiveness.

New buildings that enrich the quality of academic life at UMR are also needed to

improve and indeed sustain the quality of our undergraduate programs The campus now has an outstanding performing arts facility, the library has been extensively remodeled, the campus's physical recreation facilities are quite adequate, and the Electrical Engineering Department, previously squeezed into a building that was designed for one-half of today's enrollment, now has a major addition. Acquiring modern instructional laboratory equipment represents another challenge to the campus The advent of digital electronics and intelligent instrumentation has changed the way laboratory measurements are conducted. Ensuring that our students are educated with modern equipment is an ongoing problem. The Engineering Equipment Bill has provided significant funds for modernization of undergraduate laboratories, but more funds are needed.

Innovative approaches to instruction are an additional opportunity to ensure the continued vitality and relevance of our undergraduate programs. A serious study of general graduation requirements is being initiated by the Academic Council. A renewed interest in undergraduate education will not only enhance the quality of UMR's undergraduate programs but will, in addition, indirectly revitalize graduate education by better preparing students for graduate school and by making the university a more exciting place to attend

The second major element of our plan is to develop national eminence in selected areas of graduate education and research that are important to Missouri and the nation. While UMR has already established a national and, indeed, international reputation in several areas of research, the campus does not yet enjoy the same general recognition in research and graduate education as it does in undergraduate education Given the expense and competitiveness of research, it would be unwise to attempt to develop national eminence in research and graduate education across the full range of engineering and science subdisciplines Instead, the campus will focus its resources in those areas where the opportunities are the most attractive. Because UMR will target those areas in which the campus has existing strength, the likelihood is high that a specific program of research will achieve important progress, investments can be leveraged with funds from outside the University, and there are meaningful potential benefits to Missouri and the nation. A number of areas can be identified in which a targeted strengthening of the faculty through endowed chairs, additional fellowship support to attract high quality graduate students, and the acquisition of state-of-the-art research equipment can catalyze a dramatic change in the level of research activity at UMR. Especially attractive in this regard are several interdisciplinary areas in which the addition of a nationally recognized scholar, adequately supported by bright graduate students and modern equipment, can provide the leadership to mobilize a group of existing faculty whose combined efforts would clearly go beyond the current level of activity. The

following examples, while not intended to be exhaustive or limiting, illustrate the range of opportunities available. They include materials processing, automated manufacturing, artificial intelligence, structural design, polymer chemistry, thermal design, biochemical processing, atomic physics, mineral extraction, electric power systems, waterjet technology, and aircraft design.

The third element of our plan calls for development of new programmatic initiatives that ensure UMR's continued service to Missouri and its eminence as a technological university For a technological University that emphasizes engineering and science, the risk of obsolescence is real. Three new programmatic initiatives will be proposed for the campus:

1) Extending engineering education to nontraditional students in Missouri;
2) Mounting an education and research thrust in bioengineering;
3) Beginning an undergraduate and graduate program in computer engineering.

There is a growing need for undergraduate engineering education for nontraditional students whose circumstances make it impossible for them to come to the UMR campus; modern telecommunications technology may make it possible to bring the campus to them. Bioengineering focuses on the technological challenges that grow out of the applications of modern biology. Computer engineering will apply engineering design of advanced computational and manufacturing capabilities In comparing UMR with other technological universities of national distinction, including MIT and Georgia Tech, these programs are conspicuous by their absence These initiatives are consistent with our goal, complement existing programs, meet an important need in Missouri, are attractive to superior students, and can be implemented with modest investments.

UMR's position as it begins to implement its plan is strong. The campus has a well understood mission. It has a long tradition of planning. It has successfully implemented changes in the past. The campus has a stable funding base consisting of dependable support from the state. This financial support from the state has been consistent through periods of high and low enrollment. The income from student fees is stabilized. Student enrollment is being carefully managed to avoid underenrollment (which would result in inadequate income), and overenrollment (which would overextend faculty, staff, and facilities and thereby compromise the quality of our programs). The campus has the basic elements of the physical plant necessary for its mission. Laboratory equipment has been markedly improved recently as a result of the engineering equipment bill funded by the state. The campus has a strong computer center which provides access to a wide range of computing facilities. The library is extremely well managed and the campus has a strong support structure providing a full range of services for the students and support for scholarly and research activities of the faculty. Research

activity has expanded dramatically since 1964 and is continuing to develop. The service to the state in economic development and technology transfer are in the process of development and expansion The campus, thus, has a solid base upon which to begin to develop a program of national eminence.

GENERAL INSTITUTIONAL REQUIREMENTS

Mission and Authorization

1 a. The institution has formally adopted and made public its statement of mission

The University of Missouri-Rolla is one of four campuses that comprise the University of Missouri. The University of Missouri is a constitutionally established multi-campus, public, research University The University of Missouri is the only public institution in the state offering doctoral and advanced professional programs which has a major and expanding commitment to research, scholarly work, and creative activity

While the mission of the University of Missouri-Rolla has evolved over the decades to meet the changing needs of the State of Missouri. the major thrust of its mission has remained unchanged since the University of Missouri-Rolla was established in 1870 as the University of Missouri School of Mines and Metallurgy. The University of Missouri-Rolla is a land-grant institution for engineering and mines and is the leading center in the state for education in engineering and related sciences. The Board of Curators of the University of Missouri formally approved the statement of the mission of the University of Missouri-Rolla, which is currently in force, on March 20 1992 The mission of the University of Missouri-Rolla is stated on page 6

1 b The statement of mission is appropriate to an institution of higher education.

The mission of the University of Missouri-Rolla clearly commits it to teaching, research, and public service and indicates that the campus offers residential programs at the undergraduate and graduate levels that include a full range of engineering programs as well as a number of arts and sciences programs which complement the engineering offerings and assure a superior education for all students. The mission of the University of Missouri-Rolla is clearly that of an institution dedicated to the accepted goals of a research University dedicated to the education of undergraduate and graduate students, the creation of new knowledge through research and scholarly work, and public service to the state and nation.

1.c. The institution can confer certificates, diplomas, or degrees.

With the authority granted to it by the constitutionally established Board of Curators of the University of Missouri the University of Missouri-Rolla confers certificates, diplomas, and degrees upon those students who have met the high standards established by the faculty of the University. In the academic year 1997-98, UMR conferred 743 Bachelor of Science and Bachelor of Arts degrees, 338 Master of Science degrees, and 61 Ph D. degrees

1.d. The institution has the legal authority to confer certificates, diplomas, and degrees.

The degrees presented by the University of Missouri-Rolla are conferred by the

President of the University under the power granted by the Board of Curators of the University of Missouri, which is a constitutionally established body in the State of Missouri.

1.e. The institution meets all legal requirements to operate wherever it conducts activities.

The legal authority to operate is conferred by the Constitution of the State of Missouri, through the Board of Curators, to the University of Missouri-Rolla.

Educational Programs

2.a. The educational programs are compatible with the institution's mission.

The University of Missouri-Rolla has restricted its educational and research programs to the areas of science and engineering, as well as the liberal arts programs that complement the science and engineering offerings and assure a superior general education for all students. UMR has avoided expanding its activities beyond those specifically authorized by the mission of the University of Missouri-Rolla. This focus ensures a tight compatibility between existing educational programs and institutional mission.

2.b. The principal education programs are based on recognized fields of study at the post-secondary level.

The programs offered at the University of Missouri-Rolla (see catalogs) are all in fields of study which have long traditions at universities and colleges across the United States. There are several interdisciplinary programs offering research opportunities to students on the campus. However, students involved in these interdisciplinary programs are required to complete all of the requirements for a degree in one of the established disciplines on the campus and receive a degree in that discipline. This provides the student with the opportunity for a research program involving an interdisciplinary topic but provides a sound background in a well-established discipline.

2.c. At least one of the undergraduate programs is two or more academic years in length or the equivalent. If no undergraduate programs are offered, at least one of the graduate programs is one or more academic years in length, or the equivalent.

All of the undergraduate programs at UMR require four years or more for completion. Listed in the undergraduate catalog are the undergraduate disciplines at the University of Missouri-Rolla and the minimum number of hours required for graduation.

2.d. General education at the post-secondary level is an essential element of undergraduate degree programs and a prerequisite to graduate degree programs.

Each program at the University of Missouri-Rolla has a required general education component in each of the baccalaureate degree programs. All of the graduate degree programs require an undergraduate degree from an accredited educational institution as a condition for admission.

2.e. General education and/or a program of related instruction at the post-secondary level is an essential element of undergraduate certificate and diploma programs two or more academic years in length.

The University of Missouri-Rolla does not offer two-year certificates.

2.f. The certificate, diploma or degree awarded upon successful completion of an educational program is appropriate to the demonstrated attainment of the graduate.

Listed in the undergraduate and graduate catalogs are the requirements for the Bachelor of Arts, Bachelor of Science, Master of Science, and Ph.D degrees at the University of Missouri-Rolla. Clearly the requirements in time, course content, and course level equals or exceeds that required for attainment of the equivalent degree at other universities across the country. The appropriateness of the level of educational attainment is further demonstrated by the success of UMR graduates in their professions, on nationally normed examinations, and at the institutions which have accepted our students into their graduate programs.

Institutional Organization

3.a. There is a governing board, legally responsible for the institution, which establishes and regularly reviews basic policies that govern the institution and protect its integrity

The University of Missouri is a constitutionally established body governed by a Board of Curators consisting of nine individuals who are appointed by the Governor and approved by the State Legislature. The Board of Curators of the University of Missouri meets regularly to establish and review the policies of the University of Missouri and the University of Missouri-Rolla.

3.b. The governing board includes individuals who represent the public interest.

The Board of Curators consists of nine individuals who are appointed by the Governor and approved by the legislature. By law, these individuals are required to represent both political parties and are chosen from the various congressional districts in the state to ensure that the Board of Curators represents the State both geographically and politically. In practice, the members of the Board of Curators represent a broad range of professions and are recognized as exceptionally talented individuals who are well qualified to represent the public interest.

3.c. An executive officer is designated by the governing board to administer the institution.

The University of Missouri is administered by a President who reports directly to the Board of Curators. The local campus is administered by a Chancellor who is also appointed by the Board of Curators. These administrators report regularly and directly to the Board of Curators and have been given the

authority to effectively administer the University.

3.d. A faculty composed of persons qualified by education and experience is significantly involved in the development and review of the educational programs.

Of the tenured/tenure track faculty at the University of Missouri-Rolla, 98% hold the Ph D in the area of their discipline. This highly qualified faculty is responsible for the development of the educational program through the departmental and school or college curriculum committees and the Curriculum Committee of the Academic Council. Each curricular change must receive formal approval by vote of the entire Academic Council

3.e. Admissions policies are consistent with the institution's mission and appropriate to the educational programs.

The admissions policy of the University of Missouri-Rolla is set by the Board of Curators. This policy is consistent with the institution's mission. The admissions policy is regularly reviewed by the Academic Council, Committee for Admissions, and Academic Standards The admission requirements were recently increased to ensure that students were more adequately prepared for the program at UMR.

3.f. Admissions practices conform to the admissions policies.

Any student who meets the Board of Curator's requirements for admission to the University of Missouri-Rolla, may enroll at UMR. In actual practice, most students far exceed the minimum standards required for admission as a result of voluntary self-selection. The admissions office counsels incoming students carefully. The students are provided with placement examinations to assist them in their decision making. The campus does not provide what would normally be considered remedial work. The only remedial courses offered on campus are in college algebra and trigonometry which would be considered credit courses on most campuses but which do not apply towards degrees in science and engineering at UMR. The campus works with the community colleges in the State through Model Transfer Programs to provide a mode of access for those students whose academic preparation would not predict success at UMR.

4.a. The institution has financial resources sufficient to support its activities.

The University of Missouri-Rolla annually receives $41.9 million from the State of Missouri and approximately $32.6 million from educational and other fees. Gifts, grants and contracts provide $17.1 million In addition, the university receives income to cover auxiliary enterprises which are required to be essentially self-supporting. The campus is required to balance resources against expenditures annually.

The financial planning for the campus assures that the anticipated expenditures are brought into balance with the income at the beginning of each year. The budgeting process assures that the cost of the activities undertaken

in any given year do not exceed the available resources In 1999, a reallocation of $350,000 was required to ensure this balance.

4.b. The institution has its financial statements externally audited on a regular schedule by a certified public accountant or state audit agency.

The financial statements of the University of Missouri-Rolla are regularly audited. The University system has internal auditors. External audits are annually provided by Coopers and Lybrand.

Public Disclosure

5.a. The institution publishes in its catalog or other appropriate places accurate information that fairly describes its educational programs, its policies and procedures directly affecting students, its charges and its refund policies, and the academic credentials of its faculty members and administrators

As a public institution, the University is required to publish openly information concerning its programs, policies and procedures. The graduate and undergraduate catalogs contain information on educational programs. The Manual of Information contains information concerning the policies and procedures directly affecting students. The charges and refund policies are set annually by the Board of Curators and are published in the Admissions Handbook. The academic credentials of the faculty are contained in the graduate and undergraduate catalogs. All of the proceedings of the Board of Curators are public information and are available to any interested party. In addition, the Board of Curators publishes its own Collected Rules and Regulations, which contain all of the official policies of the University.

5.b. The institution makes available upon request accurate information that fairly describes its financial resources

The University regularly publishes its budget. The entire document is available to interested parties and is kept in the library In addition, hearings are held on each campus of the University System at least twice a year, at which the budget of the University and financial matters are thoroughly discussed. Summary documents are distributed to the faculty and to any interested parties

APPENDIX A

BASIC INSTITUTIONAL DATA

North central Association of Colleges and Schools
Commission on Institutions of Higher Education
30 North LaSalle Street, Suite 2400, Chicago, IL 60602-2504
(800) 621-7440, (312) 263-0456, FAX (312) 263-7462

Basic Institutional Data Form A

Enrollment Trends

DEFINITIONS

I. **Undergraduate.** This classification includes students enrolled in

A Bachelor's degree programs

B Associate degree programs

C Programs leading to one, two, or three year certificate or diplomas

D Clearly numbered undergraduate courses taken without a specific credential as the goal

II. **Graduate.** This classification includes those students who have attained bachelor's degrees or first professional degrees (in dentistry, law, medicine, theology, or veterinary medicine, etc) and are enrolled in a master's specialist, or doctoral degree program

III. **Professional.** This classification includes students who have enrolled in a professional school or program which requires at least two or more academic years of previous college work for entrance and which requires a total of at least six academic years of college work for a degree, for example, students enrolled for a professional degree in one of the following fields Dentistry, (D D S), Law (LL B or J D), medicine (M D), Optometry (O D) or Osteopathy (D O) All students in programs that require only four or five academic years of work (i e , only four for five years beyond high school) for completion of the requirements for the degree should be reported as undergraduate All students enrolled in work leading to a masters degree are to be reported as graduate even though the master's degree is required in some fields, such as Library Science and Social Work, for employment at the professional level

IV. **Full-time.** Use the measure the institution commonly uses to define full time student count Provide that formula on the top of the page

V. **Part-time.** Use the measure the institution commonly uses to define part time student count Provide that formula on the top of the page

IF THE INSTITUTION DOES NOT DISTINGUISH BETWEEN FULL-TIME AND PART-TIME STUDENTS, USE PAGE 4 INSTEAD OF PART 3 FOR REPORTING OF FULL-TIME EQUIVALENT STUDENT COUNT PROVIDE THE FORMULA USED TO DETERMINE THAT COUNT

VI. **Other.** Students who cannot be classified by level, including students enrolled in course that not lead to degrees

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Basic Institutional Data Form A

PART 1 - FULL-TIME ENROLLMENT (HEADCOUNT)

Opening Fall Enrollment for Current Academic Year and Previous Two Years

Name of institution/ campus reported: UNIVERSITY OF MISSOURI-ROLLA

Full-time Undergraduate: 12 or more credit hours; Full-time Graduate student: 9 or more credit hours

		Two Years Prior	One Year Prior	Current Year
UNDERGRADUATE		**1996 - 1997**	**1997 -1998**	**1998 -1999**
Freshman	Degree oriented (Definition I-A & B)	909	801	811
	Occupationally oriented (Definition I-C)	NA	NA	NA
	Undeclared (Definition I-D)	35	32	35
Sophomore	Degree oriented (Definition I-A & B)	704	667	628
	Occupationally oriented (Definition I-C)	NA	NA	NA
	Undeclared (Definition I-D)	32	22	42
Junior		752	752	718
Senior		1,395	1,304	1,339
TOTAL UNDERGRADUATE		3,827	3,578	3,573
GRADUATE				
Master's		336	304	300
Specialist		NA	NA	NA
Doctoral		185	195	220
TOTAL GRADUATE		521	499	520
PROFESSIONAL (by degree)		NA	NA	NA
TOTAL PROFESSIONAL		NA	NA	NA
TOTAL ALL LEVELS		4,348	4,077	4,093
OTHER		NA	NA	NA

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Basic Institutional Data Form A

PART 2 - PART-TIME ENROLLMENT (HEADCOUNT)

Opening Fall Headcount for Current Academic Year and Previous Two Years

Name of institution/ campus reported: UNIVERSITY OF MISSOURI-ROLLA
Part-time Undergraduate student: < 12 credit hours; Part-time Graduate student: < 9 credit hours

		Two Years Prior		One Year Prior		Current Year	
		1996-1997		1997-1998		1998-1999	
UNDERGRADUATE		Resident	Extension	Resident	Extension	Resident	Extension
Freshman	Degree onented (Definition I-A & B)	31	0	53	0	22	0
	Occupationally onented (Definition I-C)	NA	NA	NA	NA	NA	NA
	Undeclared (Definition I-D)	47	0	34	0	43	0
Sophomore	Degree onented (Definition I-A & B)	39	0	36	0	37	0
	Occupationally onented (Definition I-C)	NA	NA	NA	NA	NA	NA
	Undeclared (Definition I-D)	10	0	21	0	25	0
Junior		88	0	109	0	76	0
Senior		270	48	261	32	258	37
TOTAL UNDERGRADUATE		485	48	514	32	461	37
GRADUATE							
Master's		48	407	74	311	62	308
Specialist		NA	NA	NA	NA	NA	NA
Doctoral		84	1	81	0	81	0
TOTAL GRADUATE		132	408	155	311	143	308
PROFESSIONAL (by degree)							
TOTAL PROFESSIONAL		NA	NA	NA	NA	NA	NA
OTHER		0	0	0	0	0	0
TOTAL ALL LEVELS		617	456	669	343	604	345

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Basic Institutional Data Form A

PART 3 - FULL-TIME EQUIVALENT ENROLLMENT

Opening Fall FTE Enrollment for Current Year and Previous Two Years

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

FORMULA USED BY INSTITUTION TO COMPUTE FTE: Undergraduate FTE = SCH/15; Graduate FTE = SCH/12

	Two Years Prior	One Year Prior	Current Year
	1996-1997	1997-1998	1998-1999
UNDERGRADUATE (See definitions IA thru D)	3,966	3,708	3,711
GRADUATE (See definition II)	650	568	600
PROFESSIONAL (See definition III)	-	-	
UNCLASSIFIED (See definition VI)	-	-	
TOTAL	4,616	4,276	4,311

Basic Institutional Data Form A

PART 4 - OTHER SIGNIFICANT INSTITUTIONAL ENROLLMENTS
(e g , non-credit, summer session, other)

Most Recent Sessions and Previous Two Years

Identify types of enrollment reported: SUMMER SESSION HEADCOUNT

	Two Years Prior	One Year Prior	Current Year
	1996-1997	1997-1998	1998-1999
TOTAL UNDERGRADUATE	1,061	1,075	1,020
TOTAL GRADUATE	560	585	542
TOTAL PROFESSIONAL	-	-	-
TOTAL NON-CREDIT CONTINUING EDUCATION ENROLLMENTS (Headcount)	-	-	-
TOTAL NON-CREDIT REMEDIAL AND DEVELOPMENTAL ENROLLMENTS (FTE)	-	-	-
TOTAL OTHER	-	-	-
TOTAL	1,621	1,660	1,562

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Basic Institutional Data Form B

PART 1 - STUDENT ADMISSIONS

Opening Fall Enrollment for Current Academic Year and Previous Two Years

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

Provide as much of the following information as is available about applicants for admission in the current and previous two academic years. If exact figures cannot be supplied, careful estimates may be given. Students enrolled in a previous year should not be included as applicants in a subsequent year.

Check if appropriate ☐ Open Admissions Institutions

	Two Years Prior	One Year Prior	Current Year
FRESHMAN	**1996-1997**	**1997-1998**	**1998-1999**
Number of applicants with complete credentials for admission to the freshman class	2,139	1,874	1,872
Number of applicants accepted	2,077	1,810	1,816
Number of freshmen applicants actually enrolled	803	728	747
TRANSFER			
Number of applicants with complete credentials for admission to advanced standing (transfer)	476	448	421
Number of advanced-standing undergraduate applicants accepted	436	427	401
Number of advanced-standing undergraduate applicants actually enrolled	276	254	245
MASTER'S			
Number of applicants with complete credentials for admission to master's program	769	808	1036
Number of applicants accepted for master's program	547	588	723
Number of applicants actually enrolled in master's program	189	166	157
SPECIALIST			
Number of applicants with complete credentials for admission to specialist program	NA	NA	NA
Number of applicants accepted for specialist program	NA	NA	NA
Number of applicants actually enrolled in specialist programs	NA	NA	NA

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Basic Institutional Data Form B - Part 1 Continued

Name of institution/campus reported: **UNIVERSITY OF MISSOURI-ROLLA**

DOCTORAL	Two Years Prior 1996-1997	One Year Prior 1997-1998	Current Year 1998-1999
Number of applicants with complete credentials for admission to doctoral programs	259	287	482
Number of applicants accepted for doctoral programs	122	193	393
Number of applicants actually enrolled in doctoral programs	23	37	66

PROFESSIONAL	Reports by degrees	Two Years Prior 1996-1997	One Year Prior 1997-1998	Current Year 1998-1999
Number of applicants with complete credentials for admission to professional programs	NA	NA	NA	NA
Number of applicants accepted for professional programs	NA	NA	NA	NA
Number of applicants actuall enrolled in professional programs	NA	NA	NA	NA

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Basic Institutional Data Form B

PART 2 - ABILITY MEASURES OF FRESHMAN

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA
Specify quarter/semester reported: FALL 1998
Check if appropriate ☐ No scores used or routinely collected

A. Class ranking of entering freshman	
Percent in top 10% of high school class	50 7%
Percent in top 25% of high school class	77.6%
Percent in top 50% of high school class	95 9%
Percent in top 75% of high school class	98 9%

B. SAT scores for entering freshman[1]		
	Verbal	Math
Class average SAT score	612	664
Percent scoring at or above 500	93 3	96 7
Percent scoring at or above 600	55 5	85 2
Percent scoring at or above 700	14 8	34 0

C. Mean ACT scores for entering freshman[2]	
Composite	28 0
Mathematics	29 0
English	26 1
Natural Sciences	28 1
Social Studies	NA

D. Other tests used for admission or placement	
Test name	NA
Mean or composite	NA
Range	NA

Basic Institutional Data Form B

PART 3 - ABILITY MEASURES OF ENTERING GRADUATE STUDENTS

(Report for last full academic year)

A. Graduate Record Examination
(for total Graduate School excluding professional schools)

Range		
High	Low	Average
800	200	627 14

B. Miller Analogies Test
(for total Graduate School excluding professional schools)

Range		
High	Low	Average
NA	NA	NA

C. On a separate sheet, indicate other test data used for admission to professional programs.

[1]28.5% of Fall 1998 class had scores.
[2]93.7% of Fall 1998 class had scores.

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Basic Institutional Data Form B

PART 4 - UNDERGRADUATE STUDENT FINANCIAL AID

1997/1998

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

SOURCE OF FUNDING		TOTAL $ AMOUNT	NO. OF STUDENTS AIDED
FEDERAL	Grants and Scholarships	$1,821,660	1,519
	Loans	10,441,505	3,573
	Employment	353,224	320
STATE	Grants and Scholarships	1,962,624	3,398
	Loans	0	0
INSTITUTIONAL	Grants and Scholarships	7,851,568	2,268
	Loans	1,116,703	838
	Employment	1,168,126	1,456
FROM OTHER SOURCES	Grants and Scholarships	1,798,393	789
	Loans	122,198	28
Unduplicated number of undergraduate students aided			3,685
Number of students receiving institutional athletic assistance			193
Percentage of institutional aid for athletic assistance			1.8%

PART 4 - GRADUATE AND PROFESSIONAL STUDENT FINANCIAL AID

(Report for last full fiscal year)

SOURCE OF FUNDING		TOTAL $ AMOUNT	NO. OF STUDENTS AIDED
FEDERAL	Grants and Scholarships	$2,300	19
	Loans	1,057,123	237
	Employment	5,925	4
STATE	Grants and Scholarships	0	0
	Loans	0	0
INSTITUTIONAL	Grants and Scholarships	5,259,007	1,102
	Loans	13,400	13
	Employment	4,956,292	545
FROM OTHER SOURCES	Grants and Scholarships	339,036	122
	Loans	0	0
Unduplicated number of graduate students aided			685

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Basic Institutional Data Form C

PART 1 - FULL-TIME INSTRUCTIONAL STAFF AND FACULTY INFORMATION

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA
Specify quarter/semester reported: FALL 1998

Include only personnel with professional status who are primarily assigned to resident instruction and departmental or organized research
Exclude all nonprofessional personnel and those professional personnel whose primary function is not resident instruction, department research or organized research

	Distribution By Sex		Distribution by Race						Distribution by Age Range			
	Male	Female	White	Black	Hispanic	Asian	Native Am.	Other	20-35	35-50	50-65	65-over
Professor	137	4	120	2	2	17	0	0	0	23	107	11
Associate Professor	84	8	77	3	1	10	1	0	0	60	30	2
Assistant Professor	57	12	54	1	1	13	0	0	24	39	6	0
Instructor	7	3	9	1	0	0	0	0	2	6	2	0
Teaching Assistants & other teaching personnel	20	9	26	1	1	1	0	0	7	10	10	2
Research staff & Research Assistants	17	2	10	1	0	8	0	0	8	7	4	0
Undesignated rank	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Number of instructional staff added for current academic year	34	7	29	2	0	10	0	0	17	19	5	0
Number of instructional staff employed in previous academic year, but not re-employed for current academic year	21	4	20	1	1	3	0	0	10	11	1	3

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Basic Institutional Data Form C

PART 1 continued - FULL-TIME INSTRUCTIONAL STAFF AND FACULTY INFORMATION

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA
Specify quarter/semester reported: FALL 1998

Include only personnel with professional status who are primarily assigned to resident instruction and departmental or organized research
Exclude all nonprofessional personnel and those professional personnel whose primary function is not resident instruction, department research or organized research

	HIGHEST DEGREE EARNED					
	Unknown	Associate	Bachelor's	Master's	Specialist	Doctoral
Professor	0	0	0	0	1	140
Associate Professor	0	0	0	3	0	89
Assistant Professor	0	0	0	3	0	66
Instructor	0	0	0	9	0	1
Teaching Assistants & other teaching personnel	0	0	1	21	0	7
Research staff & Research Assistants	0	0	5	4	0	10
Undesignated rank	NA	NA	NA	NA	NA	NA
Number of instructional staff added for current academic year	1	0	2	9	0	29
Number of instructional staff employed in previous academic year but not re-employed for current academic year	0	0	0	6	0	19

PART 2 - SALARIES OF FULL-TIME INSTRUCTIONAL STAFF AND FACULTY

	MEAN	RANGE	
		Low	High
Professor	$83,311	$40,909	$143,155
Associate Professor	63,460	33,869	83,297
Assistant Professor	47,719	25,282	62,254
Instructor	35,463	21,270	52,915
Teaching Assists & other teaching peers	36,762	23,400	55,000
Research staff & Research Assists	28,694	14,727	49,177
Undesignated rank	NA	NA	NA

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Basic Institutional Data Form C

PART 3 - PART-TIME INSTRUCTIONAL STAFF AND FACULTY INFORMATION

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA
Specify quarter/semester reported: FALL 1998

Include only personnel with professional status who are primarily assigned to resident instruction and departmental or organized research. Exclude all nonprofessional personnel and those professional personnel whose primary function is not resident instruction, department research or organized research

	Distribution By Sex		Distribution by Race						Distribution by Age Range			
	Male	Female	White	Black	Hispanic	Asian	Native Am.	Other	20-35	35-50	50-65	65-over
Professor	17	0	14	1	0	2	0	0	0	1	6	10
Associate Professor	0	8	8	0	0	0	0	0	0	4	2	2
Assistant Professor	4	8	8	0	0	4	0	0	2	6	4	0
Instructor	0	0	0	0	0	0	0	0	0	0	0	0
Teaching Assistants & Other Teaching Personnel	149	55	104	8	4	88	0	0	163	29	12	0
Research staff & Research Assistants	214	53	105	5	9	148	0	0	236	24	6	1
Undesignated rank	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Number of instructional staff added for current academic year	180	51	100	5	6	120	0	0	201	21	6	3
*Number of instructional staff employed in previous academic year, but not re-employed for current academic year	168	37	111	1	1	90	2	0	163	29	9	4

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Basic Institutional Data Form C

PART 3 continued - PART-TIME INSTRUCTIONAL STAFF AND FACULTY INFORMATION

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA
Specify quarter/semester reported: FALL 1998

Include only personnel with professional status who are primarily assigned to resident instruction and departmental or organized research
Exclude all nonprofessional personnel and those professional personnel whose primary function is not resident instruction, department research or organized research

	HIGHEST DEGREE EARNED					
	Unknown	Associate	Bachelor's	Master's	Specialist	Doctoral
Professor	0	0	0	0	0	17
Associate Professor	0	0	0	1	1	6
Assistant Professor	0	0	0	2	0	10
Instructor	0	0	0	0	0	0
Teaching Assists & Other Teaching Peers	1	1	125	68	2	7
Research staff & Research Assistants	2	0	141	114	1	9
Undesignated rank	NA	NA	NA	NA	NA	NA
Number of instructional staff added for current academic year	1	0	129	84	3	14
Number of instructional staff employed in previous academic year, but not re-employed for current academic year	0	0	120	63	1	21

PART 4 - SALARIES OF PART-TIME INSTRUCTIONAL STAFF AND FACULTY

	MEAN	RANGE	
		High	Low
Professor	$33,647	$82,016	$2,745
Associate Professor	20,597	40,440	9,458
Assistant Professor	25,350	42,844	6,000
Instructor	NA	NA	NA
Teaching Assists & other teaching peers	15,570	49,776	2,400
Research staff & Research Assists	23,968	3,600	10,200
Undesignated rank	NA	NA	NA

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Basic Institutional Data Form D

LIBRARY / LEARNING RESOURCE CENTER

Report for current year and previous two years Estimate if necessary (identify estimates)

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

☐ Check here if you have specialized libraries not included in this data If you do, please identify these specialized libraries or collections on a separate page

	Two Years Prior	One Year Prior	Current Year
	1996-1997	1997-1998	1998-1999
A. USE AND SERVICE			
Total use of the collection (number of books or other materials circulated annually)	69,645	50,723	70,000
Total circulation to students	54,284	36,133	60,000
Per capita student use (circulation to students divided by number of enrolled students)	10.99	7 66	12 2
Total circulation to faculty	5,487	4,716	6,600
Per capita faculty use (circulation to faculty divided by number of FTE faculty)	13 79	11 73	15 4
Total circulation to Community Users	4,047	2,420	4,000
Number of items borrowed from other libraries via interlibrary loan	12,017	9,814	13,000
Number of items lent to other libraries via interlibrary loan	6,016	5,464	7,000
Hours open per week	97 5	97 5	112
On-line electronic database searches (usually mediated by library staff)	137	98	200
Total Library staff presentations to groups/classes	77	44	60
Tours and one-time presentations	77	44	56
Hands-on instruction for using electronic databases	53	44	60
Hands-on instruction for Internet searching	0	0	10
Semester-length bibliographical instruction	0	0	0
B. COLLECTIONS			
Total number of different titles in collection	NA	[1]34,2350	351,207
Books and other printed materials	[1]239,155	[2]191,425	194,200
Print serials/periodicals	NA	5,632	5,650
Electronic serials/periodicals	NA	1,310	[3]1,500
Other electronic materials (except serials/periodicals)	NA	160	300
Microforms	[1]96,875	[1]103,126	108,282

[1]Estimate

[2]Decrease in # of titles in 1998 as compared with 1997 accounted for by change from estimating to actual title count using the Merlin Library System

[3]The 1,500 were purchased by UMR, thus reflecting the University's activity.
An additional 2,879 were obtain in conjunction with the UM System. The total number is 4,379.

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Basic Institutional Data Form D

LIBRARY / LEARNING RESOURCE CENTER (continued)

Name of institution/campus reported: **UNIVERSITY OF MISSOURI-ROLLA**

B. COLLECTIONS (Continued)	Two Years Prior 1996-1997	One Year Prior 1997-1998	Current Year 1998-1999
Non-print materials (e g films, tapes, CDs)	[1]4,769	[1]4,842	5,050
Government documents not reported elsewhere	[1]66,857	67,842	68,850
Computer software	300	[1]563	600
Number of subscribed/purchased electronic on-line databases	NA	[1]113	150
Number of CD-ROM databases available for searches by students	NA	[1]248	300
Number of subscriptions to scholarly journals	1,284	1,301	1,325
C. STAFF (1 FTE Staff=35-40 hours per week)	31	35	35
Number of FTE professional staff	9	10	10
Number of FTE non-professional staff	16	17	17
Number of FTE students staff	6	8	6
Number of other FTE staff (please explain on back)	0	0	0
D. FACILITIES			
Seating ratio (number of seats divided by student headcount enrollment)	15	16	15
Number of publicly accessible computers	57	58	59
Estimated linear shelving space remaining for expansion	[1]11%	[1]10%	20%
Estimated linear feet of materials stored off-site	0	13,500	15,000
E. EXPENDITURES			
For staff (exclude fringe benefits)	$683,531	$733,704	$749,340
Total professional staff salaries	285,596	301,622	349,918
Total non-professional staff salaries	343,504	367,116	361,597
Total student staff salaries	54,431	64,966	37,825
For collection			
Books / other printed materials	183,129	207,023	360,000
Print serials/periodicals	650,082	661,428	722,000
Microforms	7,610	26,088	25,000
Non-print materials (e g films, tapes, CDs)	992	7,278	10,000
Government documents not reported elsewhere	0	0	0
Computer software	NA	NA	NA

[1]Estimates

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Basic Institutional Data Form D

LIBRARY / LEARNING RESOURCE CENTER (continued)

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

E. EXPENDITURES (Continued)	Two Years Prior 1996-1997	One Year Prior 1997-1998	Current Year 1998-1999
Access and other services	$109,752	$137,900	$150,000
Interlibrary loan	18,324	16,769	15,000
On-line database searches	14,483	28,090	35,000
Network membership	53,580	55,000	50,000
Binding, preservation, and restoration	21,590	22,036	20,000
Production of materials (on- or off-site)	0	0	0
Other equipment and furniture purchase/replacement	79,069	62,631	50,000
Other operating expenses (excluding capital outlay)	74,251	162,525	190,712
Total library expenses	$1,996,393	$2,140,382	$2,377,052

F. OTHER	YES	NO
Output measures:		
Does the library attempt to measure/record patron visits to the library?	X	
Does the library attempt to measure/record reference questions answered?	X	
Does the library attempt to measure/record user satisfaction?	X	
Does the library attempt to measure/record in-library use of other resources?		X
Agreements and policies:		
Are there formal, written agreements to share library resources with other institutions?	X	
Are there formal, written consortonal agreements for statewide or regional use of library materials?	X	
Are there formal, written agreements allowing the institution's students to use other institution's libraries?	X	

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Basic Institutional Data Form E

INSTITUTIONAL COMPUTING RESOURCES

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA
WorldWideWeb (WWW) URL address: http://www.umr.edu

A. ORGANIZATION, PLANNING, and POLICIES

(Please attach an organizational chart. Include names)

	YES	NO
Designated administrator(s) for institutional computing?	x	
Designated administrator(s) for Administrative computing?	x	
Designated administrator(s) for Academic computing?	x	
Centralized computing services?	x	
Formal, written, and approved technology plan?	x	
Technology plan linked to institutional mission and purpose?	x	
Computing resources included in institutional strategic plan?	x	
Policies on the purchase, replacement, and repair of hardware? ← INFORMAL →	x	
Policies on the purchase and updating of software? ← INFORMAL →	x	
Institutional computing responsible/ethical use policy?	x	
Institutional policies that include institutional computer issues?	x	
Institutional policies that include administrative computing issues?	x	
Institutional policies that include academic computing issues?	x	

B. FACILITIES

	YES	NO
Institutional network backbone?	x	
Computer labs networked?	x	
Classrooms functionally networked?	x	
Multi-media computers in labs? ← SOME →	x	
Administrative offices networked?	x	
Academic offices networked?	x	
Residence halls wired? ← 80% →	x	
Fraternities and Sororities networked?	x	

Number of non-networked computer labs: 0
Number of networked labs: 43
Total number of stations: 0
Total number of stations: 843

Type of access?

- x Wired through network
- ____ Personal computers
- ____ Wired ports
- x Internet
- ____ Remote dial-up access
- ____ Slip/ppp connection to WWW

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Basic Institutional Data Form E - Continued

FUNCTIONS: ADMINISTRATIVE (Place checks where appropriate)

	Access Available To					Via	
	Students	Faculty	Staff	Administrators	Public	Direct Access	Remote Access Modem WWW
College Activity Calendar	x	x	x	x	x	x	x
College Catalog	x	x	x	x	x	x	x
Class Schedule	x	x	x	x	x	x	x
Financial Aid	x		x	x		x	x
On-line registration	x		x	x		x	x
Student Academic Record	x	x	x	x		x	x

E-mail Intra-institution? x Yes _____ No Inter-institution? x Yes _____ No

FUNCTIONS: ACADEMIC

	YES	NO
Computers in all full-time faculty offices?	x	
Computers in full-time faculty offices networked?	x	
All part-time faculty have access to computers?	x	
All divisional / departmental offices networked?	x	
All students required to have computers?		x
Internet access available from all faculty offices?	x	
Library access available from all faculty offices?	x	
If YES, is access available to	x	
the institution's library(ies)?		x
the state-wide or region-wide library system?	x	
other libraries?		x
Library access available from all classrooms?	x	
Computers integrated into instruction?	x	
Off-campus access?	x	
If YES, is off-campus access available by		
the institutional network? ALL OF THESE	x	
the academic network? ALL OF THESE	x	
the Internet? ALL OF THESE	x	
If NO, plans to provide off-campus access within three years?		
Courses on Internet?	x	
Interactive courses in real-time (i e , 2-way video and voice?)	x	

E-mail
Intra-institution? X Yes _ No Inter-institution? x Yes ___ No

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Basic Institutional Data Form E - Continued

E. SUPPORT and TRAINING

NOTE Computing and Information Services Only-Does not include department personnel

Number of FTE technical staff? 38 Number of programmers 26
Number of FTE training staff? 2 Integrated with Human Resources unit (Y/N) N
Name and Title of the designated educational specialist? Chns Townsend/Computer Programmer II

F. FINANCES/BUDGET for COMPUTING (Current Fiscal Year)

Total Annual Academic Outlay, Operating Funds.	[1]$695,000
Total Annual Administrative Outlay, Operating Funds	393,000
Capital funds available Academic	1,310,000
Capital funds available Administrative	[2]90,000
Amount of grants/restricted purpose funds available	NA
Technology fee assessed? (Y/N)	Yes
If YES, amount per academic year?	$8/Credit Hour

G. EVALUATION

	YES	NO
Formal system of evaluation by students of academic computing?	[3]X	
Formal system of evaluation by students of administrative computing?	X	
Formal system of evaluation by faculty of academic computing?	[4]X	
Formal system of evaluation by faculty of administrative computing?		X
Systems of evaluation linked to plan to evaluate overall institutional effectiveness?	X	
Results of evaluation linked to institutional planning and budgeting processes?	X	

NOTES:

[1]Does not include staffing.

[2]Funding in administrative offices, too.

[3]Yearly survey by Student Affairs. Does not differentiate between academic and administrative computing. Student Advisory Committee provides input to Computing Services on a regular basis.

[4]Surveys by Computing Services conducted ever 1-2 years. Faculty advisory committee provides frequent input. Administrators evaluated every 5 years.

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Basic Institutional Data Form F

CERTIFICATE, DIPLOMA AND DEGREE PROGRAMS

Previous Three Years

Name of Institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

Certificates, diplomas and degrees offered by the institution, curricula or areas of concentration leading to each certificate, diploma and or/degree, number of students graduates in the past three years Include all fields or subjects in which a curriculum is offered If degree programs were not in effect during one or more of the years, please so indicate The report form may be copied if additional space is needed

CERTIFICATE, DIPLOMA OR DEGREE	CURRICULUM OR MAJOR	GRADUATES IN PROGRAM		
		1995-96	1996-97	1997-98
BACHELOR OF ARTS	ECONOMICS	0	1	1
	ENGLISH	6	8	5
	HISTORY	15	11	15
	PHILOSOPHY	0	0	0
	PSYCHOLOGY	6	10	7
BACHELOR OF SCIENCE	AEROSPACE ENGINEERING	13	17	22
	APPLIED MATHEMATICS	15	15	11
	CERAMIC ENGINEERING	11	22	17
	CHEMICAL ENGINEERING	69	76	83
	CHEMISTRY	6	12	9
	CIVIL ENGINEERING	107	127	112
	COMPUTER SCIENCE	45	45	51
	ECONOMICS	1	6	7
	ELECTRICAL ENGINEERING	90	104	89
	ENGINEERING MANAGEMENT	50	53	35
	GEOLOGICAL ENGINEERING	39	38	40
	GEOLOGY AND GEOPHYSICS	21	20	10
	LIFE SCIENCES	16	17	13
	MANAGEMENT SYSTEMS	2	1	12
	MECHANICAL ENGINEERING	125	153	125
	METALLURGICAL ENGINEERING	19	25	22
	MINING ENGINEERING	19	20	21
	NUCLEAR ENGINEERING	10	11	7
	PETROLEUM ENGINEERING	17	14	11
	PHYSICS	6	13	8
	PSYCHOLOGY	9	15	10
MASTER OF SCIENCE	AEROSPACE ENGINEERING	3	3	2
	APPLIED MATHEMATICS	7	5	10
	CERAMIC ENGINEERING	1	4	4
	CHEMICAL ENGINEERING	10	9	12
	CHEMISTRY	6	4	4
	CIVIL ENGINEERING	9	22	21
	COMPUTER SCIENCE	36	34	36

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Basic Institutional Data Form F

CERTIFICATE, DIPLOMA AND DEGREE PROGRAMS

Previous Three Years

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

Certificates, diplomas and degrees offered by the institution, curricula or areas of concentration leading to each certificate, diploma and or/degree, number of students graduates in the past three years Include all fields or subjects in which a curriculum is offered If degree programs were not in effect during one or more of the years, please so indicate The report form may be copied if additional space is needed

CERTIFICATE, DIPLOMA OR DEGREE	CURRICULUM OR MAJOR	GRADUATES IN PROGRAM		
		1995-96	1996-97	1997-98
MASTER OF SCIENCE	EARTH SCIENCES	0	0	0
	ELECTRICAL ENGINEERING	25	30	32
	ENGINEERING MANAGEMENT	139	163	160
	ENGINEERING MECHANICS	7	5	8
	ENVIRONMENTAL ENGINEERING	2	7	6
	GEOLOGICAL ENGINEERING	7	6	3
	GEOLOGY AND GEOPHYSICS	9	3	4
	MECHANICAL ENGINEERING	24	23	23
	METALLURGICAL ENGINEERING	6	6	4
	MINING ENGINEERING	2	1	3
	NUCLEAR ENGINEERING	5	1	3
	PETROLEUM ENGI - -ERING	0	0	2
	PHYSICS	6	6	1
DOCTOR OF PHILOSOPHY	AEROSPACE ENGINEERING	0	1	1
	CERAMIC ENGINEERING	3	6	1
	CHEMICAL ENGINEERING	5	3	0
	CHEMISTRY	11	8	12
	CIVIL ENGINEERING	2	4	5
	COMPUTER SCIENCE	1	4	1
	ELECTRICAL ENGINEERING	2	5	7
	ENGINEERING MANAGEMENT	23	12	13
	ENGINEERING MECHANICS	0	2	1
	GEOLOGICAL ENGINEERING	2	1	2
	GEOLOGY AND GEOPHYSICS	2	0	0
	MATHEMATICS	0	0	4
	MECHANICAL ENGINEERING	2	3	3
	METALLURGICAL ENGINEERING	4	3	6
	MINING ENGINEERING	3	1	0
	NUCLEAR ENGINEERING	1	0	2
	PETROLEUM ENGINEERING	0	1	0
	PHYSICS	4	5	3

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Basic Institutional Data Form G

INTERCOLLEGIATE ATHLETICS

Name of institution/campus reported: UNIVERSITY OF MISSOURI-ROLLA

Intercollegiate athletic programs (as opposed to intramural and/or physical education programs) involve a) formal agreements (association, league) to compete with other institutions, b) student athletes identified as members of a particular team, and c) professional staff

Provide the name(s) of the intercollegiate athletic associations in which the institution holds membership and the level of membership: Mid-America Athletic Association (MIAA) Division II

NAME OF SPORT	FOR MOST RECENT ACADEMIC YEAR										OPERATING BUDGET FOR INTERCOLLEGIATE ATHLETIC PROGRAMS (list current year last)		
	# OF STUDENTS PARTICIPATING IN INTERCOLLEGIATE ATHLETIC PROGRAMS		NUMBER OF ATHLETIC SCHOLARSHIPS		MEAN AMOUNT OF SCHOLARSHIP		NUMBER OF SCHOLARSHIP STUDENTS COMPLETING DEGREES		NUMBER OF STAFF (Use FTE)				
	Men	Women	Men	Women	Men	Women	Men	Women	Men	Women	1996-1997	1997-1998	1998-1999
MBA	33	0	29	0	1,610	$0	8	0	0 3	0	$30,113	$31,880	$32,567
MBB	13	0	10	0	9,899	0	2	0	1 79	0	108,345	116,486	119,285
WBB	0	14	0	12	0	8,141	0	7	0	1 4	98,778	104,086	117,701
MXC	20	0	6	0	1,713	0	0	0	0	0 45	12,119	13,131	13,520
WXC	0	11	0	3	0	2,667	0	0	0	0 45	12,027	13,039	13,428
MFB	68	0	66	0	4,388	0	11	0	3 45	0	306,736	322,487	321,948
MGO	16	0	8	0	1,506	0	1	0	0 2	0	13,514	13,866	14,091
MSO	21	0	14	0	1,900	0	1	0	0 44	0 17	33,109	34,665	27,154
WSO	0	18	0	16	0	2,804	0	4	0 44	0 17	33,109	34,665	27,154
WSB	0	16	0	13	0	3,468	0	4	0 2	0	20,078	22,619	26,830
MSW	21	0	17	0	2,224	0	2	0	0 8	0	65,019	69,809	44,415
MTE	8	0	6	0	4,756	0	1	0	0 3	0	16,169	10,925	11,044
MTK	35	0	11	0	1,441	0	5	0	0 3	0 45	18,998	26,727	27,420
WTK	0	19	0	5	0	3,400	0	0	0	0 45	25,701	27,797	28,614

CODES:

MBA = Men's Basketball
MBB = Men's Baseball
WBB = Women's Baseball
MXC = Men's Cross Country
WXC = Women's Cross Country
MFB = Men's Football
MGO = Men's Golf
MSO = Men's Soccer
WSO = Women's Soccer
WSB = Women's Softball
MSW = Men's Swimming
MTE = Men's Tennis
MTK = Men's Track
WTK = Women's Track

APPENDIX B

ASSESSMENT OUTCOMES

COLLEGE *of* ARTS *and* SCIENCES

Biological Sciences
105 Schrenk Hall
1870 Miner Circle
Rolla, MO 65409-1120
Phone (573) 341-4831
FAX (573) 341-4821

24 February 1999

Degree Program Objectives and Assessment of Student Learning
Department of Biological Sciences

The University of Missouri - Rolla offers the B.S. degree in Biological Sciences (formerly Life Sciences). It is a relatively new degree program, having been initiated as a preference program in Chemistry in 1972, and officially authorized as a separate degree-granting program in 1978. At the time the degree was first offered, the Life Sciences faculty consisted of three full-time faculty and one part-time laboratory instructor. The program now consists of 5 tenured or tenure-track faculty, 3 full-time non-regular faculty, and 2 part-time instructors. Within the next year we anticipate 3 additional full-time tenure-track faculty positions as part of a planned program enhancement. The program curently has approximately 85-90 undergraduate majors.

The B.S. degree program in Biological Sciences at UM-Rolla is broadly recognized by high school teachers and counselors, regional faculty peers, many prestigious graduate schools, professional schools, government and industrial labs as a rigorous undergraduate experience that has prepared our students well for a variety of post-graduate opportunities. The core curriculum within the Biological Sciences degree program seeks to introduce our students to the entire spectrum of biology, yet provides emphasis in molecular, cellular and microbiology. Principal objectives of the degree program are:

a. To collaborate with other programs in engineering, physical sciences, mathematics, and the liberal arts to offer a broad, liberal educational experience to all students who choose to attend UM-Rolla, and specifically, to satisfy the needs of UM-Rolla students who choose to pursue an undergraduate education in biological science.

b. To provide instruction in modern biological science theory and technology commensurate with the mission of the UM-Rolla campus: to educate tomorrow's leaders in engineering and science who can understand and solve technical and societal problems, adapt to change through life-long learning, and create new knowledge through research.

c. To offer to our students adequate opportunity to learn and develop requisite skills for a broad variety of post-graduate opportunities in modern society which require understanding and application of biological science.

These program goals were determined through extensive review of campus needs and resources, our recognized strengths and deficiencies, and thorough examination of curricula and supportive infrastructure of undergraduate science programs offered at other regional colleges and universities, with particular focus on what is currently being done at peer institutions with similar missions. We must admit that major impetus was given to development of our program in biological sciences by strong advice and encouragement offered by accrediting agencies like the North Central Accreditation Board, and the Accreditation Board for Engineering and Technology (ABET), formerly the Engineering Council for Professional Development (ECPD). Strong support was also expressed by faculty colleagues and administrators in various disciplines across campus who recognize the importance and need for class instruction, development of essential skills and research opportunities created through collaboration with biological scientists.

Initiation of a high quality undergraduate degree program in biological sciences on the UM-Rolla campus has offered unique professional opportunity for faculty members involved, and at the same time it has placed unusual demands on them. As we have made additions to our faculty to achieve adequate staffing for the program, and as we have planned the curriculum to meet the needs of this technologically-oriented campus, our faculty colleagues, and our students, we have been guided by the results of continuing assessment efforts.

We attempt to assess student learning by careful consideration of:

a. Student performance on common nationally-normed exams, include the GRE, MFAT, MCAT, PCAT, VAT, etc. Guided by student performance on nationally-normed exams like the Graduate Records Exam, the Major Fields Achievement Test in Biology, the Medical College Admissions Test, Pharmacy College Admissions Test, Veterinary Admissions Test, etc. we have been able to make curriculum and course content adjustments, as required to assure adequate preparation of our students. Feedback from exam results and comments of alumni through numerous solicited and unsolicited evaluations and special invited seminars provide valuable guidance for minor curriculum adjustments as well as encouragement for current students. The remarkably successful record of acceptance of our students in technical jobs, medical and other professional schools, several prestigious summer research programs and graduate schools, and continuing correspondence with these alumni clearly indicate the adequacy of the curriculum and high motivation of our students.

During the early stages of development of our Life Sciences program, our students routinely performed well above the national average on exam sections related to molecular and cellular biology, as well as human and general animal biology. Performance on exam sections dealing with botany, however, was somewhat lower than the national average. Recognizing this, we made specific efforts to include more detailed information on plant science in our introductory biology courses as well as initiation of separate lecture and laboratory courses in plant science. Recent scores of graduating seniors indicate marked improvement in this area.

b. Frequent reviews of course content, assigned texts, homework assignments, laboratory exercises, quizzes, exams and grading policies. This is sometimes accomplished through open discussion during weekly faculty meeings, more frequently during meetings and continuing discussion among faculty colleagues attempting to coordinate lecture and lab or various sections of a course, or with new faculty who might be teaching a course for the first time. Annual faculty evaluations conducted by the chair include review of teaching assignments and performance, as well as occasional interviews with students and discussion of course objectives and performance expectations. Grades reported at the end of each semester are carefully reviewed by the faculty member and the chair. Course grades and continuing academic performance as recorded on official university transcripts, especially performance in upper-level and capstone coursework, are probably the best assessment we have of overall student learning.

c. We place confidence in the ability of our faculty colleagues to offer challenging and informative classes at an appropriate depth and pace commensurate with stated prerequisites and course objectives. We encourage faculty to make themselves available to respond to students' concerns and problems with coursework. Small classes and opportunity for interaction with students in and out of the classroom contribute substantially to the learning process.

Academic Outcomes Assessment
Department Chemistry Academic
College of Arts and Sciences
University of Missouri-Rolla

Statement of Chemistry Department Mission

The four-fold mission of the UMR Chemistry Department is:

(1) To provide outstanding instruction in chemistry for students of engineering and other technical disciplines,

(2) To graduate superior B.S. Chemists in all areas of chemistry,

(3) To support the multi-faceted research and instructional structure of UMR by providing quality expertise in chemistry, and

(4) To strengthen ongoing graduate and undergraduate research programs that focus on the application of chemistry to societal needs.

The department's stated focus most directly addresses UMR's mission to educate tomorrow's leaders in engineering and science and seeks to fulfill our vision of graduating students that are prepared to solve technical and societal problems, adapt to change through life-long learning and create new knowledge through research.

Departmental Academic Assessment Objectives

An increased awareness of the quality of instruction in courses offered in the undegraduate and graduate programs is of significant concern for the Chemistry Department. The major outcomes sought from the assessment of the department's academic instruction are to strengthen faculty connection to student learning and to determine the most appropriate type and content of courses that are needed to meet the application and problem-solving skills commonly desired for graduates with strong backgrounds in chemistry.

Another objective is to continue to revise strategies that provide insight on the level of student learning in such a way as to influence the progressive development of the department's academic programs.

Departmental Assessment Processes

• Faculty Connection to Student Learning

The process that has been initiated to establish an enhanced faculty awareness of the changing nature of student learning is coupled with the department's current effort to document the level of curriculum reform efforts for undergraduate and graduate chemistry programs throughout the nation's colleges and universities. Initially, it has been determined that the need for a reform emphasis is, in part, due to the changing learning requirements for students. It is expected that a comparison of local and national factors that influence faculty awareness of student learning will make a contribution to faculty awareness of student learning and improve the potential of developing new instructional strategies. The nation-wide review has been planned as a year-long process and is expected to be completed near the end of the summer in 1999. The effort is expected to provide insigh on the quality of chemical education at the public school secondary level, the expectation of chemistry education at the undergraduate level, and the chemical education needs for undergraduate and graduate students.

• Appropriate Courses and Content

Chemistry programs that have received American Chemical Society accreditation generally adhere to an established collection of courses and course content in each of the major disciplines in chemistry. Because of the flexibility that exist within the guidelines for these courses, each division of the department conducts an annual review of the content of the courses being offered. Once every three years or so, a full consideration is made regarding the textbook used for courses. During this review, attention is given to the student's response to the textbook and general student learning in various courses.

Academic Assessment Tools and Target Outcomes

The common tools used to judge the level of learning by students in chemistry include exams, papers, projects and presentations. Inherently in chemistry, the level of student learning requires a combination of theoretical understanding with a learned intuition to apply chemical principles to solve problems. Consequently, the definitive outcomes from applying these assessment tools tend to reflect the many of the different learning styles of students.

The application of these academic assessment tools lead to some definitive outcomes In addition to a demonstration of mastering fundamental principles, students are expected to show problem-solving, critical thinking, and effective communication skills development.

The following descriptions are representative of the strategies employed by chemistry faculty to assess course content learning by students and their academic success.

Exam Questions

- Key exam questions that are embedded in tests in courses that are required by the major.
- Standardized tests.
- Multiple choice exams.
- Essay exams based on the course objectives.

Papers

- Collection of student's work throughout the academic career (portfolio model).
- Special topic papers designed to emphasize specific learning outcomes.

Projects/Presentations

- Individual and/or group research projects and presentations.changes?

Information Gathering Related to Student Academic Performance

- Advisor academic progress monitoring
- Sholarship Committee review

AN ASSESSMENT REPORT, COMPUTER SCIENCE DEPARTMENT, COLLEGE OF ARTS AND SCIENCES, UM-ROLLA

PROGRAM OBJECTIVES

Program objectives are: 1) to prepare each baccalaureate graduate for entry into the profession of computer science with a broad and rigorous technical foundation in computer science and an introductory level of specialization; 2) to prepare each graduate to become an active and contributing citizen in the civic, economic, social and professional communities, and 3) to prepare each graduate for a career enhanced by continuing education, while providing preparation for academically superior students for entry to graduate school

Describe methods which are being used on a regular basis to evaluate the effectiveness of the program. Describe the information which is collected, how it is evaluated and how it is used when considering change to the program.

At least once between each accreditation cycle the department intends to survey all its alumni with pertinent questions on the computer science program. This survey was recently done in 1994-95. The information from this survey is compiled and passed on to he faculty and our alumni through the departmental newsletter.

The information from the Alumni Survey has been used to decide rather COBOL should continue to be offered within our course offerings, the necessity/desirability of computer ethics course for our students, the determination of whether various alumni would be willing to help us with our senior project capstone course

Also, the newsletter reminds all alumni of the computer science home page and the alumni survey which can be filled out in real-time and sent to the department

The Computer Science Advisory board normally meets once a year to advise the chair on the effectiveness of the program. This input is not only used for determining effectiveness of past changes, but to determine directions of future changes in the curriculum

The Computer Science Advisory Board input has been useful in a much more subtle way in that the ideas that are presented by the Computer Science Advisory Board help us in long range planning, such as when new faculty hires are brought on board the topics that the Computer Science Advisory Board has suggested are taken into account in the suitability of the candidates In fact, this has help us to strengthen our database area which was through a new faculty member, Dr Subramanya which was an indirect result of the Advisory Board suggesting that the database area be expanded and also that some of the database concepts be introduced into our beginning file structures course This is also in the process of being implemented.

Describe the methods used for monitoring student placement experience.

The department chair interviews all graduating seniors to obtain information on interview experience, job offers, and acceptance of an offer The Career Opportunities Office also monitors student placement experience.

The information obtained by the department chairman from the graduating seniors is distributed to the faculty and this influences them in how they develop and modify various courses Again, this loop is closed in a very subtle fashion in that it may be several semesters or years before the information seems relevant and important for changing a particular course While it is hard to directly state how advise and feedback from professionals in industry are reflected in program changes/modification, they are utilized subtle in incremental changes over time There is presently one avenue which will have a direct relationship to course material and that is various alumni are being surveyed on how they feel our numerical analysis course has either benefitted or not benefitted them in their careers This will help the faculty in making a decision in whether to keep this course as a required course or transfer it to one of our elective courses

Explain the processes used for obtaining advice and feedback about the program from professionals in industry.

Primarily from the Computer Science Advisory Board, secondarily from faculty interactions with industry and visits by the chair; and finally, from continuous contact with our own graduates in industry. There is also an alumni survey form on the WEB, attached to the department's home page.

Faculty utilize the APT test in their advising effort. They also assess the student thru perusal of student comments/numerical scores on teacher evaluations, test scores, questions in class, keeping on target with respect to syllabus, reminding the student of course objectives, as stated in the syllabus, and how various topics address the items in the syllabus

VOLUME I

QUESTIONNAIRE FOR REVIEW of COMPUTER SCIENCE PROGRAM

Submitted by

University of Missouri-Rolla
Department of Computer Science
May 31, 1997

to the
Computer Science Accreditation Commission
for the
1997-98
accreditation cycle

nary contact: George W. Zobrist
ephone number: (573)341-4492

Assessment of Program Effectiveness

1. **Describe methods which are being used on a regular basis to evaluate the effectiveness of the program. Describe the information which is collected, how it is evaluated and how it is used when considering change to the program**

   At least once between each accreditation cycle the department intends to survey all its alumni with pertinent questions on the computer science program. This survey was recently done in 1994-95. The information from this survey is compiled and passed on to the faculty and our alumni through the departmental newsletter. This information is in the newsletter in the Appendix.

   Also, the newsletter reminds all alumni of the computer science home page and the alumni survey which can be filled out in real-time and sent to the department

   The Computer Science Advisory board normally meets twice a year to advise the chair on the effectiveness of the program this input is not only used for determining effectiveness of past changes, but to determine directions of future changes in the curriculum

2. **Describe the methods used for monitoring student placement experience**

   The department chair interviews all graduating seniors to obtain information on interview experience, job offers, and acceptance of an offer. The Career Opportunities Office also monitors student placement experience. The Appendix includes the senior exit interviews and relevant placement information

3 **Describe how the professional development of students and graduates is tracked**

   The Career Opportunities Center maintains continuous contact with students from the time they enter campus as freshmen until they graduate, helping them with all placement-related activities, including co-op, summer internships, and job placement after graduation

4. **Explain the processes used for obtaining advice and feedback about the program from professionals in industry.**

Primarily from the Computer Science Advisory board; secondarily from faculty interactions with industry and visits by the chair; and finally, from continuous contact with our own graduates in industry. there is also an alumni survey form on the WEB, attached to the department's home page. A list of current Advisory board members and minutes from recent meetings are in the Appendix.

COMPUTER SCIENCE ACCREDITATION COMMISSION

of the

COMPUTING SCIENCES ACCREDITATION BOARD

FINAL STATEMENT

to

UNIVERSITY OF MISSOURI-ROLLA

ROLLA, MISSOURI

Dates of Visit:	November 23-25, 1997
Team Chairperson:	Dr. John Dickinson University of Idaho Moscow, ID
Program Evaluators:	Dr. David P. Kelly Raytheon TI Systems, Inc. Dallas, TX
	Dr. Allen S. Parrish University of Alabama Tuscaloosa, AL

Assessment of Program Effectiveness

The institution has an Assessment Office that coordinates institutional assessment program. As part of the department's assessment program, it administers the Academic Profile Test to students midway through their program and the Major field Achievement Test in Computer Science to all graduating seniors. The department also uses traditional assessment methods such as exit interviews and alumni surveys. the assessments are documented and seriously considered by the department in making improvements to the program. All CSAC/CSAB criteria regarding program assessment are satisfied.

ASSESSMENT REPORT FOR UNDERGRADUATE DEGREE PROGRAMS
Economics Department
College of Arts and Sciences
University of Missouri-Rolla

MISSION STATEMENT

The mission of the UMR Department of Economics is to promote the economic education of UMR students, the local community and the people of the State of Missouri. Our mission and vision statements agree and support those of the University and of the College of Arts and Sciences.

In the context of our mission, and in response to the North Central Association's accreditation activities, the Department of Economics has prepared this report on our ongoing assessment activities. We have established a number of educational goals below and the assessment tools we intend to use to measure our program's success. Our vision is to use the combination of educational goals and evaluation tools to construct a quality, comprehensive education for our students. We also note that the UMR Economics Department is committed to insuring that our learning goals and assessment activities must support our goal of diversity and student equity.

ROLE OF ASSESSMENT

The Economics Department believes that the establishment of academic goals and assessment tools for measuring our progress toward those goals plays an essential role in managing our curriculum. We have established our goals based on the observations of the departmental faculty and the input from our various constituents including graduate schools, companies that hire our graduates, our alumni and the students we educate.

These learning goals are then incorporated into our educational program. Assessment of our students and graduates will be utilized to determine how well we are progressing toward our academic goals. The faculty will utilize the assessment information to improve the quality and relevance of our teaching offerings. This process, maintained in an ongoing manner, will allow the department to review our progress, semester by semester, toward achieving a quality program for student learning in economics.

DEPARTMENTAL GOALS AND ASSESSMENT

Goal #1: Students should understand and appreciate the basic structure of economic theory and, in particular, the use of "marginalism" as the major tool of economic analysis. Students should grasp this economic structure as a logical deductive and inductive framework of business, personal and social choices. They should acquire competence in thinking like an economist, and demonstrate skills in problem solving using economic methodology.

Assessment Tools:

1. Exit interviews for graduating seniors. The Economics Department schedules an exit interview with all its graduating seniors. The interview is designed to explore the student's perception of his or her strengths and weaknesses relative to this program's goals, and how the program has contributed to the student's development in this area.

2. Performance on nationally normed skills assessment test (MFAT exam) given to seniors. The department has had discussions concerning the use of the MFAT exam. We want to use the test results in a meaningful manner to assess student progression toward this departmental goal.

3. Measurement of student achievement via evaluation methods typical in course work. Here we would use essays, quantitative problems and factual information checks through multiple choice questions.

4. Assessment of on-going student development. The knowledge and skills developed in conjunction with this departmental goal are to a significant degree cumulative over the duration of the program. We are considering testing by exam at the beginning of each course for basic knowledge of the prerequisites.

Goal #2: Students should understand and appreciate how economics theory is used to model the choices that businesses, individuals and government make about the allocation of the scarce resources available to them for maximizing their goals and objectives. They should acquire the ability to appropriately frame simple choice problems in the context of economic models and obtain meaningful theoretical and empirical results from an analysis of these models.

Assessment Tools:

1. Exit interviews for graduating seniors.

2. Performance on nationally normed skills assessment test (MFAT exam) given to seniors.

3. Measurement of student achievement via evaluation methods typical in course work.

4. Assessment of on-going student development.

Goal #3: Students should understand the concepts of "market failure" and "efficiency." With respect to market failure, they should appreciate those economic situations where private markets work best to provide optimal outcomes and those where a role for government is required to achieve the correct social solutions.

Assessment Tools:

1. Exit interviews for graduating seniors.

2. Performance on nationally normed skills assessment test (MFAT exam) given to seniors.

3. Measurement of student achievement via evaluation methods typical in course work.

4. Assessment of on-going student development.

Goal #4: Students should understand and be proficient in the language of economics.

Assessment Tools:

1. Exit interviews for graduating seniors.

2. Performance on nationally normed skills assessment test (MFAT exam) given to seniors.

3. Measurement of student achievement via evaluation methods typical in course work.

4. Assessment of on-going student development.

Goal #5: Students should learn to conduct themselves in a professional manner as economists and should acquire proficiency in oral and written communication of economic ideas.

Assessment Tools:

1. Classroom evaluation written material and oral presentation.

2. Alumni surveys. We attempt to keep track of our graduates. We do so in order to periodically assess our preparation of them for post-graduate studies or employment and to assess their level of success. We sent out our first alumni survey two years ago and while the number of responses was modest we hope to achieve greater success in future surveys. We believe such surveys should be administered at intervals of three to five years. We will have questions on the survey targeted specifically to ask about this outcome goal.

3. Employer surveys. We will compile a list of employers hiring in economics at the undergraduate level. These employers will be administered a survey some of the questions which will be specifically targeted to ask about this outcome goal.

Goal #6: Students should be aware of and appreciate diverse groups and the constraints and objectives of different groups. Students should also appreciate the ethical dilemmas associated with policy choices that inevitably favor one group over another.

Assessment Tools:

1. Evaluation of study exams covering ethical, global, and environmental issues.

2. Alumni surveys to ask about proficiency in this outcome goal.

3. Employer surveys to ask about proficiency in this outcome goal.

Goal #7: Students should be able to individually make good choices, using economic thinking, to structure their academic program, and their job search portfolio so as to maximize, upon graduation, their opportunities in graduate school or the work place.

Assessment Tools:

1. Evaluation of student progression during the advising process.

2. Alumni surveys to ask about proficiency in this outcome goal.

FACULTY AND STUDENT INPUT AND INVOLVEMENT IN ASSESSMENT ACTIVITIES.

This assessment report has been developed by the Economics Department faculty, which is simultaneously engaged in an ongoing review of the department's academic offerings. We value our students for their input into the department and we intend to ask for their comments and suggestions on this report. In addition, information and results gathered from alumni and employer surveys as well as student interviews will be shared with the faculty and, when appropriate, students.

Department of English
Academic Outcomes Assessment Report
February 19, 1999

Mission Statement

The mission of the Department of English is to foster the development of the reading, writing, and analytical abilities of all undergraduate students.

The department fulfills its mission through the following six formal and informal programs:

1. The Bachelor of Arts in English
2. Cooperative Teacher Education Program in English and Language Arts with UM-St. Louis
3. Dual Enrollment Program - Master of Arts in English-UMR and UMSL
4. Minors in literature, writing, technical writing, literature and film, literature and science
5. Intensive English Program for non-native speakers
6. Courses in writing (exposition, research, technical, creative) and courses in American, British, and world literature and in linguistics for all undergraduates to fulfill general education and indepth requirements.

Role of Assessment

The challenge of writing a departmental Assessment Plan and preparing for the NCA visit in April of 1999 has been to identify assessment tools that are valid for our discipline, that give faculty feedback that can be used to improve student learning, and that are not purposeless or aggravating impositions on students.

Our Assessment Plan has emerged from faculty discussions and feedback from students, alumni, and potential employers. Changes--both implemented and planned for the future--are continuously discussed among these same groups. Dr. Carl Burns, UMR Academic Assessment Director, has been an excellent source of information about campus and national assessment trends and has advised us in the development of our particular Plan.

As valuable as the Plan itself is, equally valuable is the on-going faculty discussion of how to improve student learning and how to find or construct reliable assessment tools. On these issues, state and national institutions and organizations of higher education will continue to be consulted--e.g. NCA, MLA (Modern Language Association), NCTE (National Council of Teachers of English), CWA (Colloquium on Writing Assessment in Missouri), and assessment plans from other institutions.

Learning Goals and Assessment Tools

The faculty have identified three learning goals and several tools which are useful for assessing student learning in the discipline of English.

1. Knowledge of representative works in British and American literature, ranging broadly through several historical periods and balanced with an intensive study of selected subjects, e.g. author, genre, period, culture.

Assessment Tools:

- MFAT
- Senior Exit Interview
- Senior Writing Portfolio
- Capstone Course
- Written course exams
- Oral course presentations
- Course essays

2. Competent writing skills and knowledge of the English language.

Assessment Tools:

- Senior Writing Portfolio
- Senior Exit Interview
- APT
- Alumni Survey
- Homework
- Written course exams
- Course essays
- Course portfolio

3. Ability to study new literary works and texts independently and/or professionally, including the ability to acquire in-depth knowledge of the work's context, apply several critical theories, and research and document sources so as to meet the discipline's standards.

Assessment Tools:

- Capstone Course
- Senior Exit Interview
- Senior Writing Portfolio
- Alumni Survey
- Homework
- Internships
- Job Placement
- Graduate Admission

Development of Goals and Tools

As the faculty investigated and discussed assessment appropriate for our discipline, they concluded that the initial statement of learning objectives and assessment should be written by those closest to each of the department's six formal and informal programs. Therefore, groups were formed within the department to write specific statements and, when appropriate, to seek help from experts outside the department. From those statements, the three common learning goals, listed above, emerged.

Common assessment tools were also identified from these initial statements, and the selection of the current assessment tools, listed above, was made on the basis of the following preferences:

*Multiple output measures
*Qualitative and quantitative results
*Direct and indirect measures
*On-going and exit measurements

Overall, the faculty also agreed that a tightly focused Assessment Plan with a minimum number of learning goals and assessment tools would work best for the discipline of English. With a relatively small student and alumni base, an area of knowledge which is not easily quantified, and with assessment tools still under investigation and development by national experts, we concluded that a plan that concentrated on essentials could provide a solid base of information through a number of years and could be augmented in future iterations. Such an essential plan suits people who quote Ralph Waldo Emerson ("Consistency is the hobgoblin of little minds"), Ursula K. Le Guin ("Praise then creation unfinished"), Alexander Pope ("The proper study of mankind is man"), or William Shakespeare ("To be or not to be is the question")

Consequences of Assessment

Collecting data from the assessment tools has been a slow process, primarily because of the small number of graduating seniors each semester. For example, prior to 1990, specific information for the MFAT exam was not returned to the department because we regularly had fewer than five students taking the exam each semester. After 1990, by having students from a given academic year test together, we have been getting specific information from ETS. However, the numerical information from MFAT is not statistically significant since we have so few students tested each year in contrast to the number tested nationally. More immediate and relevant feedback has come from our indirect methods, such as the exit interviews with seniors and interviews with members of the department Advisory Board.

We have identified three categories of consequences of assessment, all of which have been designed to enhance student learning: (1) changes in the department program and services, (2) changes in specific courses, and (3) changes in campus-wide service.

1. Changes in the department program and services.
   *In 1997, we hired a faculty member with expertise in 20th c. British literature; MFAT scores highlighted student weakness in this area.
   *In 1997, we revised four British and American "masterpieces" courses so that they became "survey" courses; MFAT national mean scores suggested students' breadth of knowledge needed to be increased.
   *In 1996, we asked faculty teaching the masterpieces/survey courses (English 106 and 80) to be sure their assignments gave equal attention to 19th and 20th century literature; both MFAT scores and course-embedded evaluations revealed students' lack of knowledge of major works and authors.

*Since 1996, faculty have integrated more literary theory into upper-level courses (361, 362, 350). The senior exit interview revealed students felt weak in this area and experienced difficulty with these sections on the MFAT.

*Since 1995, one faculty member has been responsible for career advising; this formalization resulted from student information in the senior exit interview and advice from alums and potential employers at the annual meeting of the department Advisory Board.

2. Changes in specific courses

*English 20: Addition of collaborative oral presentations by small groups; initiated in response to passivity of students during discussions of assigned readings.

*English 105: Fuller discussion of literary terms, increased group work in class, and refining assignments; in response to mid-term, written evaluations of course.

*English 160: On papers in progress, increased one-on-one conference time with instructor and increased peer evaluation time; in response to student comments on CET evaluations.

*English 160: Refinement of contract grading system and use of computer-aided instruction; in response to student informal feedback

*English 278: Increased discussion time for papers in progress and film sequence analysis; in response to student comments on CET evaluations.

3. Changes in campus-wide service:

*In 1995, a director of Writing Across the Curriculum (WAC) was hired to initiate and direct a formal program; campus APT scores had indicated average or below-average writing scores for UMR students in all disciplines. After concern was expressed by upper administrators, the English faculty offered a solution--hire a WAC director and initiate a program which had been nationally shown to be a valid way to improve student learning in writing. The program is administratively housed in the College of Arts and Sciences; the director holds a tenured position in the Department of English.

Revising the Assessment Plan

Continuous evaluation of the department's learning goals and assessment tools is planned, involving the same groups used in the development of the Plan--faculty, students, alumni, potential employers. Plans are a bit tentative for the future, because the department faculty will select a new Chair in 1998-99 and will look to the expertise and experience this person will bring to the UMR department. However, the following five revisions and additions have been identified for fuller discussion in 1999-2001:

<u>1999-2000</u>

1. Investigate an alternative to the MFAT, either another nationally-normed test or a locally-developed test. Although our students generally fall just above or just under the

national mean, the experience of taking the exam has produced considerable dissatisfaction among students. The high number of part-time and transfer students in English at UMR may also affect the validity of the comparison between national and UMR scores. Further, in 1997, MFAT changed the exam so that scores after 1998 are not comparable to pre-1998 scores. Before 1998, 3000-4000 students took the exam nationally; after 1998, the number was under 1000; this also indicates that schools have found alternatives for assessment.

2. Develop a rubric for reading and analyzing the senior writing portfolio. Having now gathered portfolios for several semesters, the faculty believe they have a significant number of cases to examine.

3. Develop a systematic plan for surveying alumni. In 1992, an extensive alumni survey was conducted. The survey confirmed what we thought we already knew about the value of the degree. As more sophisticated surveys have emerged in the assessment literature and as we now have a larger alumni base, the faculty will discuss surveying alumni the first year out and then at some regular interval after that. A set of interview questions needs to be developed and used consistently thereafter.

2000-2001

4. Develop an assessment plan for the capstone course--English 350. The course has been taught twice, and--although informal reports on student preparation for the course and student learning in the course have been given to the faculty--assessment for the course needs to be regularized.

5. Internship opportunities in the Rolla area are being actively sought in 1999; consequently, an assessment tool needs to be identified and developed for this work/academic experience--possibly a portfolio which will be evaluated by a consistent rubric.

DEPARTMENT OF HISTORY AND POLITICAL SCIENCE
ACADEMIC OUTCOME ASSESSMENT PLAN

DEGREE OBJECTIVES FOR MAJORS IN HISTORY/POLITICAL SCIENCE

The history curriculum is designed to aid students in the development of:

1. Critical thinking
2. Analytical skills
3. Research techniques
4. Communications skills
5. Leadership qualities

Of these five objectives, paramount is that of creating a learning atmosphere in which students are challenged to think. A creative application of the mind is the primary objective of every history and political science course. From the freshman-level surveys to specialized seminars, the department's goal is for students to hone their analytical skills, develop sophisticated research techniques, using both traditional and electronic sources, and to communicate their findings in a lucid manner. The History/Political Science Department perpetually emphasizes the importance of effective communication and we remain firmly committed to the view that the classroom is an excellent venue for teaching the technical skills, as well as encouraging the creative forces, associated with effective speaking and writing.

The History/Political Science curriculum provides both breadth and depth of experience in fulfilling its stated, disciplinary goals. "Breadth" comes with the survey courses, which are designed to challenge students to master and assimilate large quantities of information dealing with the complexities of diverse societies. Upper division courses and seminars provide "depth" with their special emphasis on specific topics and time periods. Stated briefly, in survey courses the instructor assumes the major burden of developing innovative ways to involve students in analyzing a broad scope of material covered in the readings, lectures and other ancillary material, such as videos, while in upper-division history courses it is customary to place a greater responsibility on the student. The responsibility of the student, as well as the objectives of the course, are described in a course syllabus provided by the instructor. (See attached for examples)

ASSESSMENT OF DEPARTMENTAL SUCCESS IN FULFILLING ITS GOALS:

The seven assessment measures listed below provide evidence of the progress being made by students in pursuant of the established goals of the discipline:

1. Exams
2. Term Papers
3. Student Evaluations
4. Exit Interviews
5. Academic ProfileTest

6. Internships
7. Capstone Experience

Examinations:

While the objectives of the history degree program are stated "collectively," assessment of the progress being made toward the fulfillment of these objectives, is done on an individual, student-by-student basis. Students progress at different rates and experience different problems, making individual assessment mandatory. Without question one the most effective tools for measuring the progress being made toward the fulfillment of the stated goals of the discipline is the time-honored mechanism; examinations.

Examinations associated with introductory level, survey courses, usually contain an objective component (matching, multiple choice, true/false) and an essay component. By combining the two components, instructors can evaluate effectively the student's ability to process large quantities of information based on the application of their analytical, critical and literary skills. By testing the students approximately every four weeks the instructor can also identify specific problems experienced by individual students and implement corrective measures.

Classroom Discussion:

In conjunction with examinations, instructors in survey courses devote a segment of time each week to a discussion of supplemental reading material or other assignments completed outside of the classroom. Some instructors require a written report of the readings, while others quiz the students in various forms. Methods of assessment vary from instructor to instructor, but the history professors use a combination of the techniques listed above to achieve a balanced assessment. In addition to showing the level of mastery of the course material, classroom discussions provide evidence of the student's communication skills and they also help to develop the student' sense of self confidence; a quality that is essential for leadership growth. Students are informed of the periodic classroom discussions and outside writing assignments via the course syllabus provided by the instructor at the beginning if the semester.

Term Papers and Oral Reports:

Students enrolled in upper division courses are expected to assume a greater responsibility for the successful fulfillment of the course/degree objectives than are beginning level students. This means, in short, that there is a greater emphasis placed on research, writing and oral presentations for the advanced student. From the formulation of research topics to the selection of bibliography and the submission of preliminary drafts for review, a mentoring process is established between the student and the faculty member. This personal guidance is intended both to assist the students in their learning experience and to provide opportunities for the faculty to evaluate the progress of students in the fulfillment of disciplinary objectives. Within upper division courses these increased responsibilities are spelled out in the course syllabus

Student Evaluations:

The students' annual evaluation of the history faculty and courses are used in the History/Political Science Department as a corrective measure for pedagogical problems discovered in the classroom. Each faculty member consulted, testified that their courses have been directly influenced by the comments and recommendations made by students. Student evaluations are an important element in measuring the success of the department in fulfilling its mission. Student evaluation information is part of the criteria used in the Department to determine annual salary increases for the faculty. Student comments regarding course content have resulted in modifications being made in the curriculum. (Student evaluation form available if needed)

Exit Interviews:

Each year the Department Chairperson conducts exit interviews with graduating history majors to obtain candid information regarding their evaluation of the faculty, curriculum and university. While the identity of the student is protected, their comments are shared with the faculty and used to assess the strengths and weaknesses of the department.

Alumni Evaluations:

In addition to the exit interviews, the History/Political Science Department surveys its alumni, 5-10 years following their graduation, to determine how their job experience has influenced their perspective of their academic experience. Comments from alums have been particularly helpful in helping the department to evaluate the quality and nature of the history curriculum. (Evidence available if needed)

Academic Profile Test and other Nationally-Normed Examinations:

Scores on the APT are shared with the faculty and if a student scores poorly in two of the three criterion-referenced measures of the APT, (Reading, Writing, Math), the department Chair meets with the student's advisor and establishes a process whereby the advisor will track the student's progress within the areas of weakness. If the students is determined to need special assistance, the advisor will assist in such things as establishing a tutorial program for the student. Scores from the Major Field Achievement Test and the Graduate Record Exam are also used to monitor the quality of our majors. Records are available for UMR history majors that demonstrate that they usually score above the national average on nationally-normed examinations. However, the history faculty in general is of the opinion that the other assessment devices listed above are better gauges of the progress being made by the department in meeting its goals than are the nationally-normed examinations.

Internships:

Another objective measure of the history program is the feedback received from employers regarding the performance of our majors as interns Increasingly history majors participate in internships and this provides the department with outside sources of evaluation regarding how

well our majors are prepared for life in the real world. Currently, our majors perform extremely well in internship settings. Designated faculty members monitor the performance of departmental interns

History 310: Capstone Course

Perhaps the ultimate academic assessment of the success of the history curriculum comes from History 310, a course designed to test a student's ability to apply the skills, principles and knowledge they've acquired during their course of study at UMR. History 310 is structured as a "graduate course" in which students are required to demonstrate their level of proficiency with regards to 1) critical thinking, 2) analytical thinking, 3) research techniques, 4) oral and written communications, and 5) their leadership qualities. History 310, which is team-taught by five faculty members, provides a collective assessment of graduating senior's readiness for advanced study or a permanent place in the work force. To date, the results from History 310, which is based upon a utilization of all the test and measurement tools listed above, indicate that the goals and objectives of the History/Political Science Department are being met by our current curriculum, staff and structure.

Management Systems Assessment
Prepared for NCA Self Study
2/22/99

Mission: To provide a high quality undergraduate Bachelor of Science degree program in management systems This includes having a curriculum giving broad coverage of liberal arts, strong preparation in mathematics and statistics, in-depth study of relevant computer technologies, applied psychology, and economics and an introduction to business disciplines of accounting and management A secondary mission of the program is to help retain talented UMR students who decide to change majors

Measures and Places of Assessment

Multiple measures and multiple evaluators are used to evaluate the primary mission as described below

- **Management Systems Corporate Advisory Board.** Each year a board of corporate advisors comes to campus One of their tasks is to review the management systems curriculum and make recommendations for changes they feel would better prepare students for entry level positions in the computer industry as well as to educate students for life long learning They also review curricular changes proposed by faculty groups
- **Recruiters.** Each year a small subset of recruiters of management systems students for full-time, internship and coop positions are interviewed to determine how well management systems students are prepared for positions in those companies and how well entry level graduates have in their companies
- **ACM Information Systems Curricular Guidelines.** In 1997-98 academic year, the Management Systems Executive Committee did an extensive evaluation of management systems curriculum relative to the ACM guidelines for Information Systems Curricula
- **Major Field Assessment Test** Presently Management Systems majors are taking the computer science major field assessment test because there is no appropriate test for the management systems curriculum We explored trying to construct an appropriate test comprised of subtests for each of the various disciplines within the management systems curriculum, but the tests for psychology and computer science were not appropriate Students continue to take the Computer Science MFAT because they take eight courses in computer science, but we have not found the results to be useful because so much of the test covers material students have not had
- **Capstone Seminar.** As part of the capstone seminar in management systems, students take tests of their knowledge of ethics and project management They also carry out a management systems project for an external client, working as a member of a team Their external client judges students' project performance Students' ability to work as a team is judged by their team leader and peers Both of these latter results are fed back to students for their use
- **Course Grades** Each semester the average grades for management systems students are compared to the averages for the campus a whole, Arts and Sciences and the Computer Science department These comparisons are reviewed by the faculty Executive Committee in Management Systems and the Corporate Advisory Board Grades are used as a indicator of

whether students are able to handle the interdisciplinary curriculum and whether the program has become a "dumping ground" for low performing students

- **Student Success Rates.** In alternative years the success rates of students in courses in the management systems major are reviewed High rates of D, F and withdrawal are used as signals that changes in pedogogy, staffing, or course sequencing might be needed
- **Course evaluations.** In both of the management systems courses, all students are asked to complete a detailed evaluation of the course as well as the standard CET administered by the campus The detailed evaluations ask about specific aspects of the course, and solicit student suggestions for improvement. Both evaluations are reviewed by the instructor
- **Exit Interviews.** Graduating seniors are asked for their reactions to the curriculum, their favorite and least favorite courses and then suggestions for how the curriculum could be improved Students withdrawing for other reasons, prior to graduation, are interviewed whenever possible
- **Advising Survey.** Every four years ACT's Academic Advising Survey is administered and results shared with the Management Systems Executive Committee

Changes That Have Resulted From Assessment

Each year changes have been made in the Management Systems curriculum as a direct result of the outcome of the above assessment measures Below is a brief description of some of the changes made over the last five years. Statistical data are not provided because until recently, the number of majors were too small to make statistics comparisons meaningful

- **Introductory programming language changed from Pascal to C++.** The Corporate Board felt Pascal was a language graduates would never use, and that heir chances for excellent coops and careers might be jeopardized if they did not have the C++ language Monitoring students' success rates in this course since that time have led us to advise students to wait until their second semester on campus to take their first programming course
- **Social Psychology** A recommendation from almost all graduates is that either social psychology or organizational psychology be dropped, as they perceived the two courses were very similar In our latest revision of the curriculum, social and organizational are no longer required, but are one of five advanced psychology classes that can be taken
- **Statistics.** Review of students' grades and background, and discussion with instructors suggested that the statistics sequence was not of sufficient rigor for management systems students Two statistics courses were replaced with two higher level statistics courses, specifically addressing our concern that statistics be calculus based and reinforce the notion of statistics as decision making tools in the context of business decisions
- **Networking Course** Some graduating seniors complain about the networking course in their curriculum This stimulated questions to employers and graduates that revealed their strong endorsement for the course, which has remained in our curriculum Additionally, a networking course is part of the ACM ISO standards
- **Pedagogical Practices.** Monitoring of students' success rates in courses has led us to advocate changes in an instructor's practices, advising a different sequence of courses, and selection of differing instructors in the advising process
- **Calculus II.** Feedback from advisory groups, exit interviews, interviews with recent graduates and our review of IS curricula standards led us recently to eliminate Calc II as a

graduation requirement The requirement was not essential to the students' professional preparation, and led some good students to move elsewhere to complete their degrees

- **Capstone Seminar** Student and recruiter feedback led us to retain the challenging projects for external partners in the capstone course Students wanted to do "real" work and recruiters feel this is a strength of the students' preparation The ACM IS Standards' ethics requirement led us to incorporate ethics into the capstone course as it was lacking elsewhere in the curriculum

  Feedback from the external clients for the project students complete, as well as students' evaluation of that course, suggest that some students have difficulty conceptualizing and structuring ambiguous problems We will be investigating other places in the curriculum where we could address this ability
- **Project Management.** Recruiters of management systems students spontaneously comment on the value of project management knowledge so this was added as an elective to many of the emphasis areas
- **Student Quality.** Monitoring student performance relative to other departments initially showed that the fear that management systems would become a dumping ground was being realized Consequently, a 2 5 minimum GPA is required for UMR students to become management systems majors
- **Systems Analysis and Design.** Our review of the ACM IS Guidelines has shown us that at least one course in systems design and analysis is needed and we are working with Engineering Management to get such a course offered
- **Introduction to Management Systems.** Students' interest in hearing even more about the field of management systems, and their interest in meeting people working in industry resulted in four to five speakers being invited to speak to this class about their work in the IT field

DEPARTMENT *of* MATHEMATICS *a*
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Assessment Report

Department of Mathematics and Statistics
College of Arts and Sciences
University of Missouri - Rolla
February 19, 1999

I. Mission

The mission of the Department of Mathematics and Statistics is multifold. As a doctoral granting department, it must contribute to the growth of mathematical knowledge through research by its faculty and graduate students. As a bachelor's and master's degree granting department, it must train mathematically competent employees for all sorts of technologically advanced business and industrial employers, as well as for the teaching profession. Because of the importance of mathematics at a technological university , it must provide an education to the students on this campus which produces mathematically literate leaders in science and engineering. The department must be a resource for students and faculty in other disciplines and foster research in all areas of mathematical sciences. Finally, it must provide public service as appropriate for a state land-grant institution.

II. Objectives

The educational objectives of the department's degree programs include:

A. offering a high quality undergraduate education to students majoring in applied mathematics, preparing them either for careers in technologically advanced industries or for graduate study in mathematical sciences;

B. expanding an excellent program of teacher training for men and women planning to enter the teaching profession;

C. offering a variety of programs at the master's level to prepare students for the workplace as well as further study of mathematics or statistics;

D. contributing to the growth of knowledge in mathematics and statistics through research and graduate education;

E. offering a high quality doctoral program to those graduate students choosing to pursue the Ph.D.

III. Assessment

The principal way educational objectives are assessed by the department is through the performance of our students. Student performance takes several forms.

A. In the courses we teach, traditional assessment by means of homework, examinations, projects, and class participation is central. The value of a course is determined by the skills and abilities the students develop in the course, and these skills and abilities are measured by evaluating the students' performance. The feedback to the instructor from both examinations, etc. and student evaluations of teaching serves as an ongoing indication of the degree of success that instructor is having in that course that term, and this feedback is used to maintain and improve the course in both the short and the long term.

B. For M.S. students who write a thesis and for Ph.D. students, the thesis or dissertation is an important assessment instrument. Research connected with a thesis or dissertation can also result in puiblications or presentations involving assessment by external (to the university) experts in the field of the research. Similar assessment may occur when undergraduates get involved in research.

C. Master's degree students who do not write a thesis must take a comprehensive examination, and Ph.D. students must take both a qualifying examination and a comprehensive examination.

D. Additional assessment information for undergraduates comes from their performances on the Senior Assessment Examination, i.e., the Major Fields Assessment Test, or MFAT. Student performance patterns on this test help the department identify strengths and weaknesses in our program. For example, about ten years ago, the Senior Assessment Exam showed that our students did not perform as well in abstract algebra as they did in analysis. This discrepancy was addressed by hiring some faculty whose research is in abstract algebra who have developed the department's course offerings in this area. At the same time, we have maintained our strength in analysis.

E. Each graduating Senior is invited to an exit interview with the department chair. In this interview, with confidentiality assured, the students are encouraged to candidly discuss their educational experience and are given a chance to suggest improvements. Here, the students get to assess the department's performance.

F. After students graduate, their performance is measured by their success in a career. For some, graduate study is an intermediate step where the usual measures of academic success apply. The department tries to maintain contact with alumni by means of an annual newsletter as well as personal communications. Every year, some of our alumni come back to campus and visit the department. Often they talk to our current students about their careers, and they nearly always give the department feedback about the value of their education at UMR. This kind of interaction helps the department stay current concerning the market for our graduates and the skills needed by our graduates to succeed.

Department of Philosophy and Liberal Arts

Mission Statement

Within the academic plan concerning the Arts and Sciences program on the UMR campus--to complement engineering and science and provide opportunity for a baccalaureate degree--the Philosophy and Liberal Arts Department faculty is particularly concerned with providing an undergraduate education of the highest quality; to ensure course offerings that enhance both the thrust of the other liberal arts programs and the engineering programs; to offer courses in which the fundamental approaches and methods of philosophy and the liberal arts will be conveyed; and to provide a quality program in the Philosophy major. The only degree program in the PLA department is the BA in Philosophy.

Role of Assessment

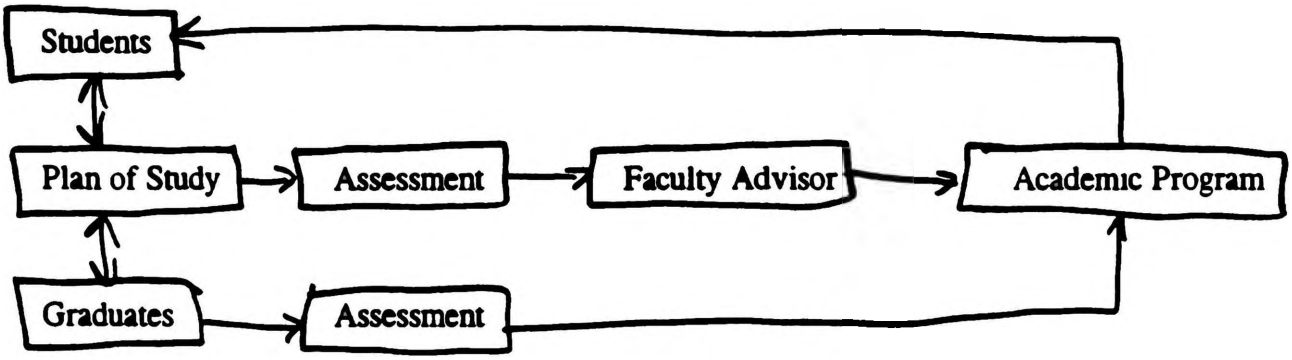
The primary goal of assessment plays a unique role in the evaluation of the individual intellectual development of philosophy majors. After completing introductory courses in general philosophy and logic, students design their own plan of study to fit their professional goals, the faculty advisor assesses the success of the plan of study for each student each semester. Adjustments are made in the plans of study and in the curriculum offerings to meet the study plans of students.

The general assessment of majors is accomplished using:

- APT
- GRE
- Exit interviews

Assessment results are used to help students design their own plan of study in relationship to their professional goals and to change the curriculum.

Systems View of Assessment



Learning Goal and Assessment Tools

The department grants only a BA degree in philosophy. The stated goals are intended for all courses. Measurement tools are noted as "direct" or "indirect" measures, they are currently in place.

Goal #1: Students should master the fundamental of philosophy to meet their professional objectives.

Tools:
1. Student program of study (direct).
2. Evaluation of student senior project (direct).
3. Information from exit interview (direct).
4. Performance on GRE (direct).

Goal #2: Students should develop the following characteristics of good philosophical thinking: critical thinking, resourcefulness, problem solving, and research skills.

Tools:
1. Evaluation of student papers (direct).
2. Evaluation of student oral presentations in class and at the Philosophy Forum (direct).
3. Evaluation by peer reviews at external conferences (indirect)

Goal #3: Students should develop the ability to effectively communicate philosophical material.

Tools:
1. Evaluation of student papers (direct).
2. Evaluation of student oral presentations in class and at the Philosophy Forum (direct).
3. Evaluation by peer reviewers at external conferences (indirect).

Goal #4: Students should understand their role in society and their responsibilities.

Tools:
1. Evaluation of case studies covering ethical, global, environmental, social issues (direct).
2. Evaluation of oral presentations in class and at Philosophical Forum (direct).

Point of Clarification on Assessment Tools

The department uses general comprehensive evaluations to review and, if needed, change its curriculum. It also uses quality indicators provided by its students to modify, change, or adjust its curriculum.

The following general assessment tools are used by the department to assess its majors:

APT
GRE

Speech and Media Studies Faculty
Department of Philosophy and Liberal Arts

Mission Statement

Within the academic plan for the Arts and Sciences program on the UMR campus--to complement engineering and science and provide academic courses in communication studies and leadership--the Speech and Media Studies faculty is particularly concerned with providing an undergraduate education of the highest quality by ensuring that course offerings enhance both the science and engineering curricula and the other liberal arts programs, by offering courses in which the fundamental approaches and methods of speech communication and the liberal arts will be conveyed; and by providing quality minor programs in communication studies and leadership to all enrolled students.

Role of Assessment

The primary goal of assessment within the Speech and Media Studies curricula is to evaluate the responsiveness of our curricula to the communicative needs and competencies of UMR students and to ensure that all students who enroll in our courses acquire the basic skills needed in order to communicate effectively in public, small group, and interpersonal environments. In addition to completing the basic communication course, students may design their own plans of study to fit their professional goals, with the minor advisor assessing the success of the plan of study for each student vis the curricula each semester. Adjustments are made in the plans of study and in the curricular offerings to meet the maturing plans and needs of students.

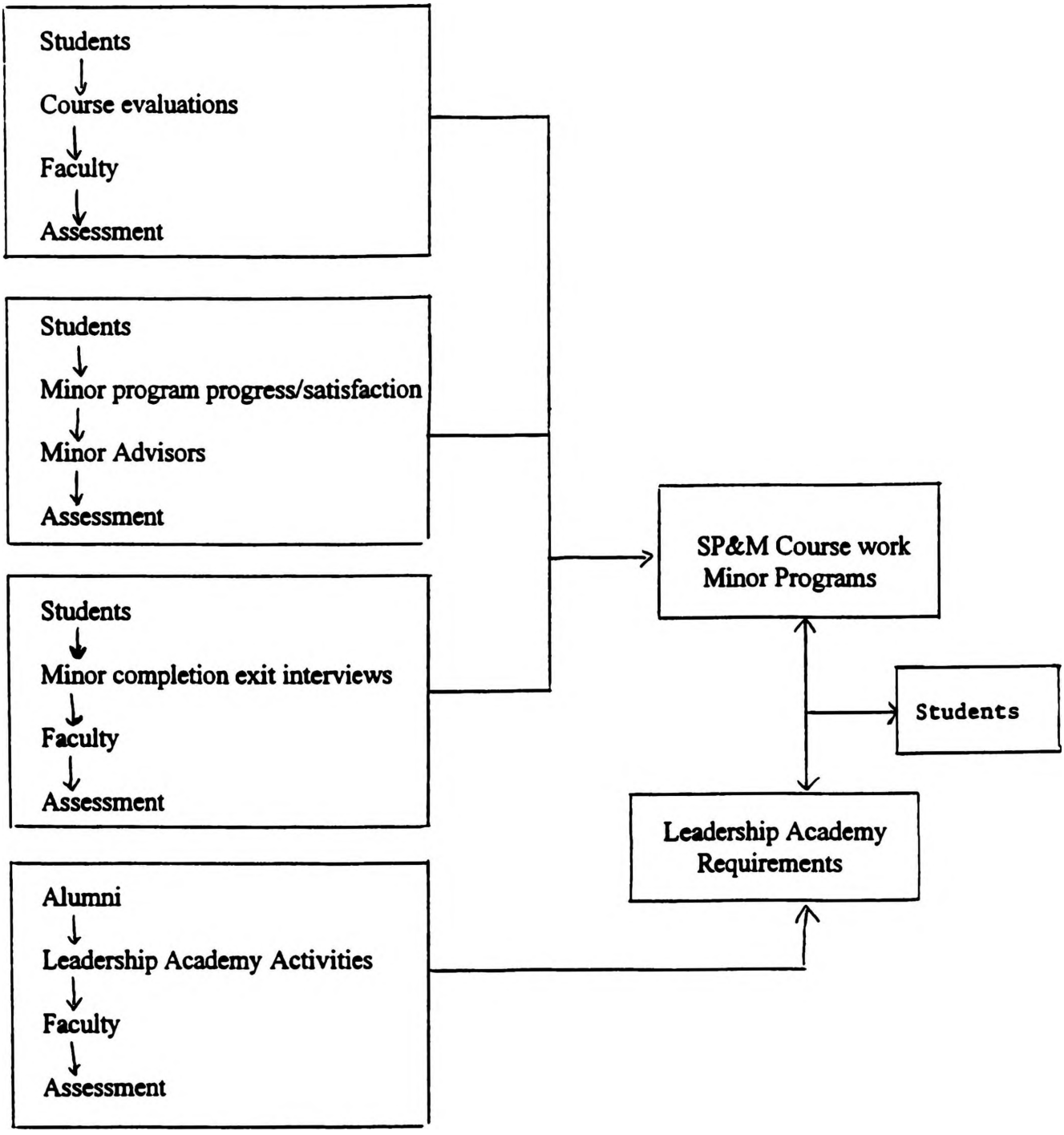
Through this systematic review, the Speech and Media Studies faculty have, in the past decade, developed four new courses, revised the traditional communication minor to create a contemporary minor and communication studies and an entirely new minor in leadership communication. Additionally, and in cooperation with alumni advisors, course curricula are frequently updated.

The general assessment of student satisfaction, as well as the comprehensive success of all course and minor program offerings, is accomplished through a course evaluation instrument that asks each student to describe his/her experience in each course in the context of making recommendations to other students. These instruments are reviewed by the faculty each semester and curricular changes are developed as appropriate. This procedure has been in practice since 1984.

These results are amplified upon through exit interviews with minor students upon completion of their curricula.

Further, the Speech and Media Studies faculty's close relationship with the Excel Center, and particularly with the Excel Leadership Academy, offers the faculty a unique opportunity for continued relations with alumni who have completed SP&M coursework. As a result, leadership minor curricula are kept current with feedback provided by alumni on the needs and demands of corporate employment.

Systems View of Assessment



Learning Goal and Assessment Tools

The department grants minors in Communication Studies and in Leadership Communication. The stated goals are intended for all courses.

Goal #1: Students should master the fundamental of communication to meet their professional and personal objectives.

Tools: 1. Student program of study (direct).
2. Student course evaluations (direct).
3. Information from exit interview (direct).
4. Alumni Feedback (direct).

Goal #2: Students should develop particular competence in the following type of communication: public, interpersonal, small group, organizational, and leadership. Students will also develop competence at modern research methods and critical thinking.

Tools: 1. Evaluation of student papers (direct).
2. Evaluation of student oral presentations in class and during Leadership activities (direct).
3. Evaluation by peer reviews at external activities associated with the Leadership Academy (indirect).
4. Alumni progress in corporate career paths (indirect).

Goal #3: Students should develop the ability to creatively produce communicative outcomes that match their intentions.

Tools: 1. Evaluation of student papers (direct).
2. Evaluation of student oral presentations in class.
3. Evaluation by peer reviews at external activities associated with the Leadership Academy (indirect).
4. Alumni progress in corporate career paths (indirect).

Goal #4: Students should understand, aspire to, and fulfil their chosen roles in careers and in personal life, with particular attention to understanding the methods of public communication in shaping opinions, attitudes, and expectations.

Tools: 1. Evaluation of leadership practicum projects
2. Evaluation of student oral presentations in class.
3. Evaluation by peer reviews at external activities associated with the Leadership Academy (indirect).
4. Alumni progress in corporate career paths (indirect).

Physics Department Assessment Report

Overview and Mission Statement

Assessment is done on a continuing basis in the UMR Physics Department. It is especially important because we are near or at the top of many outstanding departments at UMR and often make comparisons on a regular basis with the relative progress of our students. The quality of our undergraduate students and program have significantly increased in the last few years. Our majors now typically have the highest grade point average of any relatively large department at UMR (over 75% of these grades were earned in non-specialty physics courses). We also have the highest fraction of honor students (about 2/3) of any relatively large department. We have recruited the only "perfect" students to come to UMR. These three "perfect" students had the top score possible on the ACT (36) or SAT (1600) exam. Annually, there are only about two dozen high school students in Missouri who achieve these results and we are very proud to have them select Physics at UMR for their college choice. These three students have an accumulative grade point average which exceeds 3.9 (out of 4.0) based on 18 semesters at UMR (all A's except for four B's). However, for proper assessment, there is a continuing need to compare our students with other nationally normed test data as they progress through our program. This is being done and the test results analyzed on a regular basis. Some of the recent results are mentioned in the last section of this report.

Assessment of physics majors is an on-going part of our yearly and daily activities as outlined in the next section below. This is done to ensure that the Physics Department is fulfilling its mission. This mission is to educate students in the fundamental principles and methods of physics. This education is offered to all UMR engineering and science students at the introductory level, principally to physics majors and minors at the intermediate level, and to graduate students at the advanced level. In addition, the faculty pursue research activities to maintain their intellectual skills, to advance science and contribute to technical knowledge, and to educate the next generation of scientists and educators. In all these endeavors the department strives to provide a stimulating and challenging environment to ensure that all its students have an excellent start toward their professional development and to help them attain their fullest potential.

The department's mission is an integral part of UMR's mission -- to educate future leaders in science and engineering. The department fully supports all UMR science and engineering programs. The department provides the fundamental physics background needed to develop these future leaders. We strive not only to establish a firm qualitative and quantitative understanding of physics, but also to incorporate versatile methods of analysis important to most technical careers. Furthermore, skills are encouraged and developed which enable students to better communicate in both oral and written formats. The department supports interdepartmental collaboration as evidenced by the number of co-listed courses, as well as the provision of a minor in physics.

Assessment Activities

Physicists are rather broadly trained compared to others who earn a technical B S degree. They are usually highly valued by employers because they can attack a wide range of technical problems and have a diversity of skills including computing skills, mathematical skills, laboratory training, and have done data analysis. They are trained to look at a problem with broad prospective, make simplifying approximations where appropriate, and carefully examine issues using standard problem solving methods. These traits are difficult to assess directly, but a serious effort is being made.

A major objective of our assessment procedures is to insure ourselves that students have learned the physics fundamentals covered in each course. In addition to graded homework assignments which are typically done weekly, regular written tests and quizzes in each course are used as assessment tools. The department also requires that at the end of each non-laboratory course a final be given which covers all the fundamental material in the entire course. The grades from the homework, regular tests, and the final constitute a large fraction of the overall course grade.

Experimental courses are handled differently. This is especially the case in each semester of our two semester advanced laboratory course, which is used as our capstone course. In this course which is required of all our majors, a team of physics majors, usually three, select a research project to study for a semester. Projects are basically open ended and to make progress the students must actually become involved in discovery and research to put together aspects of physics which they have learned in previous courses. Their activities are carefully monitored in every laboratory session and a major assessment of their progress is carried out just before mid-semester and during the last week of the semester. At these special times, each student in the group is required to make a 10 minute oral presentation on the aspect of the project which they have been most concerned with. In addition, the research team is required to submit a written report on the activities of the group, the progress made, and future plans. After only one semester, most students have developed a technical presentation style which is better than most talks which one sees at professional conferences. In addition, they all have participated in organizing and writing a lengthy (at least 50 page) technical report with figures and tables. Many of these projects are reported by the students at various meetings, such as the Harold Q Fuller Undergraduate Research Seminar, the OURE annual research competition, and the collegiate section of the Missouri Academy of Science. Although it is difficult to precisely assess this training, we feel the demands, rigor, and special skills learned by the students in this course will benefit them greatly on the job.

Many of our undergraduates are involved with research projects being directed by our faculty. These jobs are part-time during the school year, but often full time in the summer. They provide excellent professional training. Each year for the last several years, at least one undergraduate has presented a research paper at a national meeting of physicists. For example, this year four of our majors have

won travel awards to make presentations at what will be the largest meeting of physicists ever at the annual March meeting of the American Physical Society in Atlanta Often these undergraduates are co-authors on papers published in physics journals In the last three years, two undergraduates have been co-authors of papers in the most prestigious physics journal, *Physical Review Letters* Such accomplishments are quite noteworthy, although their importance is difficult to directly assess

Both the undergraduate and graduate curriculum committees make a periodic review of all courses to be sure they are meeting the needs of our students Changes made in recent years include adding an additional credit hour to the advanced laboratory to properly credit the additional oral and written work now expected, making a major revision in the nuclear physics course which has been changed to cover all of sub-atomic physics, as well as cosmology, strongly recommending that students take at least one, preferably two courses in C^{++}, rather than the Fortran course, and revision in our offerings in astronomy We have also added a course on general relativity In addition, textbooks for most of the elementary courses and some of the upper level and graduate courses are regularly updated and changed

Two nationally normed examinations are given to assess our majors on their development at UMR The Academic Profile Test (APT) is taken by most of our sophomores as part of UMR's overall assessment plan This test enables us to compare the early, more general abilities and skills of our students with students who take the test at other universities, as well as other students at UMR The results consistently and clearly indicate that UMR students do considerably better than those at other universities in the testing program They also consistently and clearly indicate that UMR physics students do considerably better than UMR's average Recent test results from the APT and a more detailed summary are provided in Tables I-A and I-B of the next section

The other national normed test taken by our students when they are seniors is the Physics Section of the Major Field Assessment Test (MFAT) This test has several sections which specially assess knowledge in various sub-fields of physics. The average results of our senior class can be compared to those of other physics departments at universities using this test Our senior class average has been consistently well above average and often above the 80th percentile level compared with the other physics departments, whose students are often the collective best at their university Recent results from the MFAT tests and a more detailed summary are provided in Table II of the next section

Physics graduate students are assessed using assigned homework and classroom examinations In addition, they must pass the Qualifying Exam, have regular detailed discussions and reviews of their research and course work with their major advisor, and report regularly on their progress and research program to their M S or Ph D Committee They must pass a comprehensive exam on their course work Before graduating, they will have written a thesis and must pass a final oral defense Normally, all students make a presentation at a national physics meeting and have at least submitted a written research paper to a leading physics journal before they get their degree

Recent Examples of Physics Student Performance

Results from the APT

Tables I-A and I-B provide a summary of recent results for all physics majors who took the nationally normed APT test. Provided for comparison purposes are the average results for all UMR students and the overall averages of all universities using the test. Even though one must be careful drawing too many conclusions from a rather small sample, the tables clearly show that our students are consistently well above UMR's average. Very few of our students have a score below UMR's average. In addition, UMR's average is consistently above the all university average. Every year a few of our students score 490 or better (500 is the maximum score). Such scores are in the very top percentiles. Our classes considerably improved with the freshmen class of 1994. Unfortunately, this was the first year the test was given at UMR and no earlier data is available for comparison. An excellent class took the test in the fall of 1996 and the average would have been very high except for one student who appears to not have taken the test seriously.

Table I-A. Recent Academic Profile Test (APT) Results 1994-96.

(Data Fall '95 not currently available.)

Semester	Score		Semester	Score		Semester	Score
Fall '94			**Winter '95**			**Winter '96**	
Student #1	481		Student #1	481		Student #1	461
Student #2	494		Student #2	486		Student #2	494
Student #3	488		Student #3	469		Student #3	479
Student #4	480		Student #4	458		Student #4	475
			Student #5	459		Student #5	490
Physics aver.[1a]	**486**		**Physics aver.[2a]**	**471**		**Physics aver.[3a]**	**480**
UMR aver.[1b]	**460**		**UMR aver.[2b]**	**463**		**UMR aver.[3b]**	**464**
All univ. aver.[1c]	**457**		**All univ. aver.[2c]**	**457**		**All univ. aver.[3c]**	**457**

1a) Physics average was nearly one and one-half standard deviations above UMR average
1b) UMR average was over one-half of a standard deviation above all university average
1c) All university average included 12 other universities

2a) Physics average was about one-half of a standard deviation above UMR average
2b) UMR average was nearly one and one-half standard deviations above all university average
2c) All university average included 12 other universities

3a) Physics average was about one standard deviation above UMR average
3b) UMR average was nearly one and one-half standard deviation above all university average
3c) All university average included 12 other universities

Table I-B. Recent Academic Profile Test (APT) Results 1996-98.
(Data for Winter '97 and Fall '97 not currently available)

Semester	Score		Semester	Score		Semester	Score
Fall '96			**Winter '98**			**Fall '98**	
Student #1	497		Student #1	447		Student #1	491
Student #2	477		Student #2	488		Student #2	479
Student #3	489		Student #3	460		Student #3	490
Student #4	492		Student #4	483		Student #4	486
Student #5	493		Student #5	499		Student #5	496
Student #6	448		Student #6	491		Student #6	482
Student #7	486		Student #7	487		Student #7	479
Student #8	474					Student #8	485
Physics aver.[4a]	**482**		**Physics aver.[5a]**	**479**		**Physics aver.[6a]**	**486**
UMR aver.[4b]	**467**		**UMR aver.[5b]**	**467**		**UMR aver.[6b]**	**469**
All univ. aver.[4c]	**457**		**All univ. aver.[5c]**	**452**		**All univ. aver.[6c]**	**452**

4a) Physics average was about one standard deviation above UMR average
4b) UMR average was nearly two standard deviations above all university average
4c) All university average included 12 other universities

5a) Physics average was about two-third of a standard deviation above UMR average
5b) UMR average was nearly three standard deviations above all university average
5c) All university average included six other universities

6a) Physics average was about one standard deviation above UMR average
6b) UMR average was three standard deviations above all university average
6c) All university average included six other universities

Results from the Physics MFAT

Starting with the class of 1993, the Physics Department started requiring that all our seniors take the Physics MFAT for assessment purposes. Table II is a series of sub-tables which provide a summary, on an annual basis, of the Physics MFAT results for all our physics majors

Each sub-table of Table II shows two types of percentiles. Each line of the main portion of a sub-table provides the percentile for each student. The summary (last) line in each sub-table gives a percentile provided by MFAT which is relevant to the *departmental average*. This percentile is based on the relationship of the departmental student average score to the same average score from other

physics departments in the universities using the test Since physics departments typically have above average scores, a high percentile for our departmental average score is especially noteworthy

Table II Assessment Test Scores of Physics Student Scores on Physics MFAT 1992-97

Percentile given on the summary line is relevant to the department (see text)

Sub-table II-A. Class of 1992-93.

#	Grad Date	UMR GPA	MFAT Score	%ile
1	Dec 92	3 180	177	94%
2	Dec 92	3 224	162	80%
3	May 93	3 571	195	99%
4	May 93	2 503	163	81%
5	May 93	3 645	169	89%
6	May 93	2 436	175	93%
7	May 93	2 679	168	88%
8	May 93	2 491	143	42%
9	May 93	3 619	177	94%
1992-93 averages (9):		**3.039**	**170**	**97%**

Sub-table II-B. Class of 1993-94.

#	Grad Date	UMR GPA	MFAT Score	%ile
1	Dec 93	3 307	149	58%
2	May 94	2 420	120	5%
3	May 94	2 790	132	19%
4	May 94	2 970	149	60%
5	May 94	3 500	172	91%
6	May 94	3 210	168	87%
7	May 94	2 560	156	66%
8	May 94	3 110	146	53%
1993-94 averages (8):		**2.983**	**149**	**69%**

Sub-table II-C. Class of 1994-95.

#	Grad Date	UMR GPA	MFAT Score	%ile
1	Dec 94	3 486	152	64%
2	May 95	2 385	138	32%
3	May 95	3 239	172	91%
4	May 95	3 740	151	61%
1994-95 averages (4):		**3.213**	**153**	**79%**

Sub-table II-D. Class of 1995-96.

#	Grad Date	UMR GPA	MFAT Score	%ile
1	Dec 95	3 054	149	58%
2	May 96	3 967	163	84%
3	May 96	3 923	163	84%
4	May 96	3 675	177	96%
5	May 96	3 500	160	79%
6	May 96	2 772	137	27%
7	May 96	3 739	171	91%
1995-96 averages (7):		**3.519**	**160**	**93%**

Sub-table II-E. Class of 1996-97.

#	Grad Date	UMR GPA	MFAT Score	MFAT %ile
1	Dec 96	2 634	142	40%
2	Dec 96	3 160	126	5%
3	Dec 96	3 008	145	46%
4	Dec 96	3 124	146	50%
5	Dec 96	3 530	157	73%
6	May 97	3 561	160	77%
7	May 97	3 971	186	98%
8	May 97	3 302	142	40%
9	May 97	3 713	138	32%
10	May 97	3 964	172	91%
11	May 97	3 956	186	98%
12	May 97	3 837	154	68%
13	May 97	3 485	148	54%
14	May 97	3 526	160	77%
1996-97 averages (14):				
		3.484	**154**	**81%**

Sub-table II-F. Class of 1997-98.

#	Grad Date	UMR GPA	MFAT Score	MFAT %ile
1	May 98	2 835	142	40%
2	May 98	3 849	163	84%
3	May 98	3 891	155	71%
4	May 98	3 120	152	66%
5	May 98	3 099	142	40%
1997-98 averages (5):				
		3.359	**151**	**73%**

There are several items of note which standout in the sub-tables First, many of our students typically score above the 80th percentile. For example, in the specially strong class of 1993 (Sub-table II-A). all but one student scored 80th percentile or better. One would also expect a positive correlation between UMR GPA and MFAT percentile since both are making somewhat related assessments In the 1993 class, the two highest GPA students got the highest MFAT scores Also, the weakest GPA students got the lowest MFAT scores except for Student #7 who was clearly a bright, underachiever The other sub-tables show similar data For example, last year's class was a relatively weak class for us But again. the high GPA students got the high MFAT scores and the lower GPA students got the lower MFAT scores It is assessment results like these that suggest to us that our grading system is reasonable and in line with results from nationally normed tests

We are also reasonably satisfied with the departmental percentiles shown on the last line of each sub-table Our scores are often above the 80th percentile and this is a very competitive pool consisting

only of university physics departments Also, there is a good correlation between the departmental average GPA and the departmental MFAT percentile

This year's class is one of the best ever and we look forward to getting and analyzing their scores The overall performance of our students, especially as measured by these exams, annually rejuvenates the department by pointing out the quality of our students and program.

Department of Psychology
ACADEMIC OUTCOMES ASSESSMENT

Mission Statement

The mission of the Department of Psychology is to develop, implement, and maintain high quality undergraduate degree programs for psychology students and students in the sciences, humanities, and engineering. We offer both B A. and B S. degrees programs plus minor programs in General Psychology and Industrial/Organizational Psychology. Departmental courses cover the major topics of basic research in the cognitive and behavioral sciences and their applications in clinical, educational, and industrial practice. Our programs support the campus mission of providing a full range of degrees in engineering, science, and the liberal arts.

Assessment Strategy

Our learning goals are designed and assessed for students majoring in psychology, but are appropriate for non-majors as well. Each course in the department includes specific objectives (see syllabi) relevant to one or more of the five goals outlined below. Course related assessment is used to measure learning directly. A broader assessment of the curriculum involves a nationally-normed test of student achievement and a survey of alumni conducted every five years. Performance in the capstone course (senior seminar or undergraduate research) is also useful in evaluating the overall impact of the curriculum in achieving our goals.

Using the Data

The departmental faculty are currently engaged in an extensive review of the B.A. and B.S. curricula. The nationally normed data from the MFAT, alumni surveys, and course related assessments have been important sources of information in this recent effort. The alumni surveys used in the past may be modified so as to target all of the five learning goals. Exit interviews of graduating seniors have been used in the past without learning much in the way of criticisms or suggestions for change. However, a proposal under consideration is the development of a senior survey targeted to measure each learning goal.

Finally, it must be recognized that Goal 5 below is difficult to assess quantitatively and possibly cannot be validly assessed at all. It is nevertheless an important goal of our courses and research activities and so we include it despite the inherent measurement problem. The department will continue to consider tools that might yield reliable and valid data for Goal 5.

Faculty, Student, and Alumni Involvement

The current assessment plan has been devised by the department chair and faculty. We plan to involve the Departmental Advisory Board in the future along with the student representatives. The Advisory Board includes alumni and employers who can bring an external perspective to our assessment efforts.

Learning Goals and Assessment Tools

Goal 1: Graduates should understand both the breadth and depth of research and practice at a level appropriate for entry into graduate or professional degree program.

Tools:

1. Performance on the MFAT given to seniors and based on national norms.
2. Performance on assignments and exams in required and elective courses.
3. Information gathered in a survey of graduates from the previous five years.

Goal 2: Graduates should have a sound working knowledge of experimental design, univariate statistics, and psychological research methods.

Tools:

1. Performance on the MFAT given to seniors and based on national norms.
2. Performance in the required Experimental Psychology course.
3. Performance in the required Capstone Course.

Goal 3: Graduates should be able to demonstrate the ability to gather relevant information, critically evaluate sources, and reason and solve problems effectively.

Tools:

1. Evaluation of projects assigned in required and elective courses.
2. Performance in the required Capstone Course.
3. Information gathered in a survey of graduates from the previous five years.

Goal 4: Graduates should be able to communicate effectively in written and oral language. In particular, they must be able to present written arguments in the language of the discipline, using the elements of style and scientific presentation of *The Publication Manual of the American Psychological Association (4th ed.)*.

Tools:

1. Evaluation of written and oral work in required and elective courses.
2. Performance in the required Experimental Psychology course.
3. Performance in the required Capstone Course.

Goal 5: Graduates should know the ethical principles governing psychological research and practice that recognize the dignity of all human beings and the scope of human diversity.

Writing Across the Curriculum Program
Dr Linda S Bergmann, Director
Associate Professor of English

UNIVERSITY of MISSOURI-ROLLA
227 Humanities-Social Sciences Building
1870 Miner Circle
Rolla, MO 65409-0560

To Dr Lance Williams
Associate Dean, College of Arts & Sciences

From Dr Linda Bergmann LSB
Director of Writing Across the Curriculum

Subject Mid-Year Report on Writing Across the Curriculum

Date February 11, 1999

Enclosed are three documents that show the growth of the Writing Across the Curriculum program during this academic year

- A list of the 22 courses that have been designated Writing Emphasized Although this is a sizable number of courses, not all of the Writing Emphasized courses are taught each semester

- A summary of use of the Center for Writing Technologies, comparing the fall 1998 semester with the 1997-98 school year We held 195 tutoring sessions last semester alone, as compared to 273 for the entire previous school year As the number of Writing Emphasized courses has grown, so has the number of the tutoring sessions, since some of these courses require or reward students for consulting with a tutor on a draft of their paper

- A more detailed list of tutoring sessions during the Fall 1998 semester, indicating the major and year of students tutored, students' names have been removed from this list to protect their confidentiality

So far this semester, we have seen an even greater increase in the number of tutoring sessions, as faculty in all disciplines are beginning to refer students--and sometimes entire classes--to the Writing Center I think you will be pleased by the enthusiastic response of both students and faculty to the Writing Across the Curriculum Program

e-mail wac@umr.edu Telephone (573) 341-4685 / (573) 341-4436 FAX (573) 341-4600

Writing Across the Curriculum Program

WE Courses

College of Arts & Sciences

Department	Course	Title
Chemistry	Chemistry 228	Organic Chemistry Lab II
Economics	Economics 345	Energy Economics
History & Political Science	History 175	American History to 1877
	History 176	American History Since 1877
	History 259	History of Missouri-1700 to Present
Psychology	Psychology 140	Methods in Behavioral Research

School of Engineering

Department	Course	Title
Chemical Engineering	Chemical Engineering 253	Chemical Engineering Economics
	Chemical Engineering 258	Chemical Process Safety
Civil Engineering	Civil Engineering 313	Composition and Properties of Concrete
Electrical Engineering	Electrical Engineering 204	Electromechanics
Mechanical Engineering	Mechanical Engineering 242	Mechanical Engineering Systems

School of Mines & Metallurgy

Department	Course	Title
Metallurgical Engineering	Metallurgical Engineering 216	Metals Characteristics
Mining Engineering	Mining 218	Mine Atmosphere Control
	Mining 322	Mine Management
	Mining 376	Mined Land Reclamation
Nuclear Engineering	Nuclear Engineering 204	Nuclear Radiation Measurements
	Nuclear Engineering 307	Nuclear Fuel
Petroleum Engineering	Petroleum Engineering 132	Petroleum Production Lab
	Petroleum Engineering 242	Petroleum Reservoir Lab
	Petroleum Engineering 302	Offshore Petroleum Technology
	Petroleum Engineering 303	Environmental Petroleum Applications
	Petroleum Engineering 347	Petroleum Engineering Design

Center for Writing Technologies

December 1998 Mid Year Report - Summary

The Center for Writing Technologies opened for the 1998-99 school year on August 31, 1998. It closed on December 16, 1998 at the end of the semester. The Center was open for a total of 86 days this semester.

	Total 1997-98	Fall 1998
1. Student visits recorded		
Use of the Center	715	557
Tutoring	273	195
2. Courses using the Center		
Classes	14	8
3. Tutoring Sessions		
Arts & Sciences Majors	120	82
Mines & Met Majors	21	13
Engineering Majors	78	93
Undecided	11	7
Graduate Students	58	18
ESL Students	89	41
Male Students	180	141
Female Students	93	54
4. Tutoring Referrals		
Referred by Professors	142	92
Miscellaneous Referrals	13	12
Walk-ins	118	91
5. Student Evaluations		
Recommended Center		94%
Rated a 4 or 5 for Tutor Help		90%
6. Faculty Survey		
Center Recommended		100%
Student Papers Improved		100%
7. Writing Assistants Employed		
Arts & Sciences Majors	7	3
Engineering Majors	4	5
8. Workshops Held		
Faculty Workshops	2	1
Career Opportunity Workshops	2	1
Rolla Writing Project	1	

Center for Writing Technologies

Majors Tutored, Fall 1998

School of Engineering – 72 Total Sessions

Major	Student	Year	Visits
Atmospheric Science (1 Session Total)	——	2	12/8/98
Chemical Engineering (11 Sessions Total)	——	1	10/14/98 11/11/98 12/9/98
	——	1	10/6/98
	——	2	12/10/98
	——	2	10/4/98 10/25/98 11/15/98
	——	1	9/21/98
	——	4	10/2/98 11/3/98
Civil Engineering (6 Sessions Total)	——	PhD	10/2/98
	——	PhD	8/31/98
	——	4	9/23/98
	——	5	11/19/98
	——	5	11/16/98
	——	5	11/19/98
Electrical Engineering (34 Sessions Total)	——	4	9/16/98
	——	5	9/21/98
	——	4	9/21/98
	——	4	9/21/98

—	PhD	10/25/98 11/5/98 11/22/98
—	5	9/16/98
—	5	9/16/98
—	5	9/16/98
—	2	11/18/98
—	2	11/23/98
—	4	9/21/98
—	4	9/21/98
—	1	9/9/98
—	4	11/17/98 11/20/98
—	4	10/26/98 11/16/98 12/9/98
—	4	9/16/98
—	2	11/23/98
—	3	9/21/98
—	4	9/15/98
—	5	9/14/98
—	4	9/21/98
—	5	9/21/98
—	4	9/21/98
—	3	11/20/98
—	4	9/21/98
—	5	9/21/98
—	4	9/15/98
—	4	11/24/98
—	4	12/13/98

Engineering Management (2 Sessions Total)	——	4	11/30/98
	——	4	12/2/98
Mechanical Engineering (18 Sessions Total)	——	4	11/15/98
	——	2	10/6/98
	——	4	9/14/98
	——	3	9/17/98 10/1/98 10/14/98 10/15/98 11/11/98
	——	5	12/2/98 12/4/98
	——	5	9/23/98
	——	5	9/30/98
	——	5	12/1/98
	——	5	11/9/98
	——	3	9/4/98 9/11/98
	——	PhD	9/11/98
	——	5	11/24/98

School of Mines & Metallurgy – 12 Total Sessions

Major	Student	Year	Visits
Ceramic Engineering (3 Sessions Total)	——	3	12/7/98
	——	PhD	9/14/98 10/5/98
Geological Engineering (4 Sessions Total)	——	4	9/22/98 10/19/98 12/1/98
	——	2	12/13/98
Geophysics (1 Session Total)	——	4	12/9/98
Mining Engineering (1 Session Total)	——	3	12/15/98
Petroleum Engineering (3 Sessions Total)	——	1	9/15/98 9/24/98 10/20/98

College of Arts & Sciences – 102 Total Sessions

Major	Student	Year	Visits
Biochemistry (2 Sessions Total)	——	2	12/4/98 12/13/98
Biological Sciences (6 Sessions Total)	——	2	12/8/98
	——	4	11/18/98 12/3/98
	——	4	12/1/98
	——	5	11/10/98 12/1/98
Chemistry (1 Session Total)	——	2	11/5/98
Computer Science (28 Sessions Total)	——	1	12/7/98
	——	1	11/8/98
	——	3	10/8/98 12/8/98 12/10/98
	——	4	12/9/98
	——	3	12/3/98 12/13/98
	——	4	12/9/98 12/15/98
	——	5	10/8/98
	——	2	12/3/98 12/10/98
	——	4	10/11/98 12/13/98
	——	2	10/11/98
	——	3	11/19/98 12/3/98

	—	5	11/23/98 12/9/98
	—	2	11/30/98 12/1/98
	—	4	12/7/98 12/15/98
	—	2	12/6/98 12/13/98
	—	2	12/8/98 12/14/98
Economics (3 Sessions Total)	—	2	12/4/98 12/10/98
	—	4	11/17/98
Education (10 Sessions Total)	—	PhD	10/30/98 11/1/98 11/10/98 11/13/98 11/15/98 11/18/98 11/22/98 11/22/98 12/1/98 12/14/98
English (7 Sessions Total)	—	1	10/28/98
	—	1	10/4/98 12/6/98
	—	1	10/13/98 10/14/98 11/10/98 12/10/98
History (9 Sessions Total)	—	3	10/19/98
	—	4	9/17/98 9/21/98
	—	3	10/11/98 12/15/98
	—	2	10/8/98 12/10/98

	___	2	11/23/98 12/7/98
Management Systems (20 Sessions Total)	___	2	12/1/98 12/2/98 12/3/98
	___	2	12/9/98 12/9/98
	___	3	11/19/98 12/15/98
	___	1	9/28/98 10/21/98
	___	3	12/8/98 12/14/98
	___	1	11/19/98 12/10/98
	___	4	10/12/98 10/13/98
	___	3	11/17/98 12/8/98 12/15/98
	___	3	12/8/98
	___	3	12/9/98
Mathematics (11 Sessions Total)	___	2	10/15/98
	___	3	9/13/98 10/27/98
	___	2	9/17/98 9/21/98 9/22/98 10/5/98 10/26/98 11/10/98 12/7/98 12/13/98
Physics (3 Sessions Total)	___	2	11/20/98 12/9/98
	___	4	12/9/98

Psychology **(2 Sessions Total**	——	**2**	**12/8/98** **12/10/98**

Miscellaneous – 7 Total Sessions

Major	Student	Year	Visits
Staff (1 Session Total)	—	Staff	10/21/98
Undecided (6 Sessions Total)	—	1	9/17/98 10/1/98 11/12/98
	—	2	9/24/98 10/15/98
	—	1	9/23/98

Assessment of Student Academic Achievement
Aerospace Engineering Program
University of Missouri-Rolla
Undergraduate Program

Program Educational Objectives

Statement of Program Educational Objectives

Undergraduate

1 To provide students with a strong background in mathematics and physics.
2 To provide a comprehensive foundation of knowledge in the areas of aerodynamics, materials, structures, stability and control, propulsion, and aerothermochemistry including cross-linkage between the areas
3 To develop a broad understanding of basic engineering principles and to apply these principles to a meaningful aerospace engineering systems design experience.
4 To maintain a vigorous research program and to use the results of this research to enrich the undergraduate program

M.S.

1 To prepare students for entry at an advanced level of proficiency into the aerospace engineering practice.
2. To prepare students for entering a Ph.D. program of study in aerospace engineering.

Ph.D.

1. To prepare students for entry into aerospace research as a practicing engineer
2. To prepare students for entry into the academic community

Consistency with Institutional Mission

[*Show how the objectives relate to the mission and vision statements.*]

Significant Constituencies

The significant constituencies of this program are the faculty, staff, students, parents, employers, and alumni. These are the groups of people who have specific reason to be concerned with the welfare of this program, and who should therefore be included in the information channels.

Processes for Establishing Objectives

The aerospace committee established initial objectives for the undergraduate degree program. Evaluation and feedback was solicited from the constituencies, particularly the faculty, students, and industrial advisors. Final approval was by the aerospace faculty. The Graduate committee primarily maintains graduate degree objectives.

Relation of Program Curriculum to Objectives

In this section, it will be shown how elements in the curriculum address the objectives specified above

Undergraduate

Objective 1

The early part of the curriculum focuses on the foundational sciences, e g with 33 credit hours of Chemistry, Math, and Physics. A grade of C or better is required in many of these courses, reflective of the necessity to be well grounded before moving into further application of the principles involved At each stage, previously developed principles are applied in developing new concepts, e g. physics uses a calculus-based approach, dynamics builds on a vector and calculus basis The entire prerequisite sequencing is designed to provide a foundation

Aerospace student understanding of basic math and physics is monitored by their performance in early departmental courses, EM 160 – Dynamics, and ME 219 – Thermodynamics. If problems are encountered they are discussed with the appropriate departments and instructors

Aerospace students' performance in the basic area of Fundamentals of Engineering Exam, (FE), is monitored. This allows the program to assess the students' attainment and retention of basic math and physics skills. If any deficiencies are observed the appropriate departments will be contacted to develop corrective measures. No deficiencies have been observed, however, if they were say in the mathematics area then the mathematics department would be contacted and a plan would be formulated to correct the deficiencies.

Objective 2

Aerospace students are provided with a case study in their first sophomore aerospace course. They analyze design problems in nine required aerospace courses on this case study. The design problems they solve have cross linkages between the various technical areas. Their performance is monitored as they progress through the program. If any weak areas are encountered the proper technical courses will be modified. In AE 280 and AE 281, Aerospace System Design I & II, the students design, manufacture, and flight-test remotely piloted aircraft.

After several teams had problems with various manufactured aircraft stability the programs' stability and control course, AE 261, was modified to bring more practical applications aspects of aircraft stability and control.

In AE 233 students were unhappy about the textbook situation. The course was using part of their thermodynamics text and part of John Anderson's Hypersonic text. The notation was different. The cost was high. The instructor wrote a set of notes for the course based on the

material covered from the two books using consistent notation, etc. The department printed the notes and sells them to the students for about $15.00 The students are satisfied with this approach as per their comments on the class evaluation and the instructor's personal feedback.

Technical performance (both individual and group) on the aerospace senior design project is monitored and compared with previous students If any significant change in performance is observed the aerospace faculty will discuss it and a plan will be developed to correct the problem

Objective 3

Aerospace students are first introduced to aerospace systems design in AE 180 in their sophomore year In this course they are required to design, construct, and test two small aircraft models. Students' progress is assessed through three main sources of data received from the students: 1) weekly oral briefings in the classroom, 2) technical memos and reports, 3) performance and interaction with peers in the laboratory These oral, written, and interpersonal responses are continuously examined by the course instructor and teaching assistant. The received data is utilized as a feedback on their progress as well as a source of information on targeting the competencies that need to be improved. Both technical as well as social competencies are monitored. Progress on technical proficiencies such as students ability to connect between theory and application (what to do vs. how to do it) and their ability to compare theoretical predictions with test results are carefully monitored. Further, social competencies such as communication skills (listening and sending convincing messages), working with others toward shared goals, and creating group synergy in pursuing a given goal are carefully evaluated. Based on these assessments, strengths and weaknesses are identified and corrections are made as needed.

In AE 280 and AE 281, Aerospace Systems Design I & II, students are presented with a request for proposal (RFP) for a remotely piloted aircraft to perform a specified mission with appropriate constraints, including cost. Missions include aerial reconnaissance, retrieval of objects on the ground, and heavy lift capability, and often require an innovative aircraft configuration. Design groups of six to eight students are formed to respond to the RFP Based on the acceptance by the instructor of a conceptual design proposal, the groups proceed with a final design proposal, construction of the aircraft, and flight-testing. To address the recommendations of former students, visitors from industry and members of the departmental Academy of Mechanical Engineers (distinguished alumni), considerable importance has been placed on emphasis in the design proposal on team structuring, working to a schedule, design for manufacturability and manufacturing processes. The design task creates an environment in which teamwork and interpersonal skills are developed. Preparation and presentation of weekly design reviews and four formal preliminary or final design reports provides exposure to realistic communications scenarios.

Industrial visitors as well as the course instructor assess the oral presentation of the final design report of each semester. The course instructor assesses the written formal reports. Assessment of overall student performance is based primarily on the clearly observable success of the flight test and the meeting of goals set in the design proposal. Design groups

are assigned a group grade, however individual performance can be recognized by adjustment of the group grade for each student. This additional assessment involves observation of student effectiveness in the communications tasks and contributions to group success, which are at least partly measured by peer evaluations within the groups

In some cases additional measures of success are available. One group generally enters the SAE AERO design competition for heavy lift aircraft and participates in the fly-off in Florida. UMR teams, always entering with a new design, usually with minimal flight-testing, perform admirably in the competition, and in 1998 finished in the top ten of over thirty entries. In 1999 another team will participate in a Boeing sponsored design forum which includes presentation of a formal design briefing in Wichita

Objective 4

The faculty's success in bringing research to the classroom is assessed by students stimulated to do independent research with any of the four undergraduate research programs, OURE – Opportunities for Undergraduate Research Experience, NASA Space Grant Consortium Grant, departmental honors program, and the five year master's program. Students are encouraged to work with faculty in their area of interest on an individual research project Several students have presented the results of their research experiences either as AIAA student papers or as papers at national, professional society technical meetings In 1997-98 nine undergraduate students, five graduate students, and five high school students conducted research under the NASA Space Grant Program. This is over forty percent of the junior, senior and graduate aerospace students.

Graduate

At the M S. level all students are required to enroll in a core curriculum that ensures an advanced understanding of all fundamental areas of aerospace engineering. Additionally, all students are required to enroll in a minimum of 6 hours of thesis research and to produce a thesis at the end of their program. Not only does this requirement ensure an advanced competency in a specific area but it prepares those considering pursuing a Ph.D.

At the Ph.D. level, 60 course-hours are required beyond the B.S. to help the student develop an advanced understanding of engineering fundamentals. Verbal communication and teaching skills are reinforced through an oral (and written) comprehensive exam along with an oral dissertation defense. Opportunities are provided to students to serve as graduate teaching assistants to further strengthen teaching skills. Publishing of research results is strongly encouraged throughout a student's program.

Program Outcomes and Assessment

Program Outcomes

Undergraduate

Students graduating from this program should have
(a) An ability to apply knowledge of mathematics, science, and engineering.
(b) An ability to design and conduct experiments, as well as to analyze and interpret data.
(c) An ability to design a system, component, or process to meet desired needs
(d) An ability to function on multi-disciplinary teams.
(e) An ability to identify, formulate and solve engineering problems
(f) An understanding of professional and ethical responsibility.
(g) An ability to communicate effectively
(h) The broad education necessary to understand the impact of engineering solution in a global and societal context.
(i) A recognition of the need for, and an ability to engage in life-long learning.
(j) A knowledge of contemporary issues.
(k) An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) A knowledge of chemistry and calculus-based physics, with depth in at least one.
(m) An ability to apply advanced mathematics through multivariate calculus and differential equations.
(n) An ability to develop computer programs to solve engineering problems.
(o) An ability to work professionally in aerospace systems.

M.S.

In addition to the expectations for B S. students, students graduating from this program should have
(a) An advanced knowledge base in the fundamentals of Aerospace Engineering.
(b) An ability to apply advanced knowledge in one or more specialty area of Aerospace Engineering.
(c) The ability to direct a significant project to its completion.
(d) The ability to communicate scientific results in written and oral presentations.

Ph.D.

In addition to the expectation for the M.S. students, students graduating from this program should have:
(a) The ability to apply engineering skills to discover new knowledge.
(b) The ability to communicate new knowledge to the professional community.

Relation of Outcomes to Educational Objectives
[Show how the Outcomes are related to the Objectives]

Undergraduate

Graduate

At the M.S. level, advanced study of both the fundamentals of Aerospace Engineering as well as in specialty area is necessary to have an advanced proficiency in the field. The direction of a significant technical project in addition to the ability to communicate the

results allow the student to move more easily into an engineering field which traditionally requires such abilities. These also prepare a student for dissertation work at a Ph D level. At the Ph D level, demonstration of the ability to discover new knowledge, whether this be new principles, concepts or methods, is key to entry into the field of research The research may be in the academic, industrial or national lab setting In any of these settings, effective communication of research findings to peers and industry is vital

Processes to Assure Achievement of Outcomes

Assessment Tools

Undergraduate

1. Pass rate from Fundamentals of Engineering Exam
2. Alumni surveys.
3. Industrial surveys.
4. Graduating Senior surveys
5. Student body surveys.
6. Assessment of capstone design projects by faculty and Academy
7. Performance in certain key courses.
8. Direct feedback from Industrial Advisory Committee

Graduate

1. Alumni Surveys.
2. Requirement to maintain a 3 0 or greater grade point average in upper level courses
3. Acceptance of thesis (M.S.) or dissertation (Ph.D) written report by the student's thesis or dissertation committee.
4. Approval of oral defense at both M.S. and Ph.D. level.
5. Acceptance of papers and presentations in professional journals and conferences.

Performance in Criteria

[Describe how it will be known if the students satisfy the Outcomes.]

Undergraduate

Graduate

At the M.S. and Ph.D. level, alumni surveys will be distributed to assess past students' perception of the effectiveness of the advanced study in preparing the student for engineering practice or pursuit of further advanced degrees. Given a range of "poor" to "excellent", an average response of "good" is desired. Acceptance of the thesis/dissertation and of the oral defense committee will be reported by the student's thesis/dissertation committee to the department and the Dean's Office. Acceptance of thesis/dissertation and oral defense by the student's committee will be required for graduation. The requirement to maintain a 3.0 or greater grade average will be monitored by the department. Minimum desired performance

levels for papers and presentations are acceptance of one refereed conference paper for a M S. and two journal articles for a Ph D student

Data to Demonstrate Satisfaction of Outcomes

[Show assessment data that demonstrates actual performance levels]

Feedback Processes

Evaluation

Ensuring that the assessment data is critically evaluated in a timely and regular manner is the responsibility of Associate Chair for Aerospace Engineering The Aerospace Committee has the primary responsibility for identifying weak performance areas and tracking changes in previously identified weak performance areas.

The Associate Chair for Graduate Affairs has the primary responsibility for ensuring that assessment data is obtained in a timely and regular manner for the graduate program. The department Graduate Committee, which is chaired by the Associate Chair for Graduate Affairs, has the primary responsibility for identifying and proposing to the faculty any changes to address weak performance areas.

Action Items

The Aerospace Committee will report evaluation results to the aerospace faculty of the department. The committee may recommend specific action items to address areas of weak performance. The aerospace faculty of the department has the ultimate responsibility to identify and approve specific action items to be pursued. The Department Chair has the responsibility to assess workloads and assign tasks to appropriate individuals or committees accordingly. The Associate Chair of Aerospace Engineering has the responsibility to track the progress of each action item to its completion. The Department Chair has the responsibility to include the action items in the budget process.

Similarly, for the Graduate Program, the Graduate Committee will recommend to the faculty specific action items to address areas of weak performance. The faculty of the department has the ultimate responsibility to identify and approve specific action items to be pursued. The Associate Chair for Graduate Affairs has the responsibility to track the progress of each action item to its completion. The Department Chair has the responsibility to include the action items in the budget process.

Accountability

The assessment data will be published and made available upon request to any of the constituencies of the program. Meetings of the Aerospace Committee will be

open to representatives of any of the constituencies. Once each year, the Associate Chair of Aerospace Engineering will issue a written report, to be made readily available to all of the constituencies of the program, which summarizes the status and progress of the action items that are currently active An action item will remain active until it is either reported as accomplished or the aerospace faculty rescinds it.

For the Graduate Program, the assessment data will be made available upon request to any of the constituencies of the program Meetings of the Graduate Committee will be open to representatives of any of the constituencies Once each semester, the Associate Chair for Graduate Affairs will issue a written report, to be made readily available to all of the constituencies of the program, which summarizes the status of the graduate program.

February 17, 1999

Department of Chemical Engineering
ACADEMIC OUTCOMES ASSESSMENT PLAN

Mission Statement

The mission of the Department of Chemical Engineering is to develop, implement, and maintain high quality undergraduate and graduate programs in the field of chemical engineering. Our mission and vision statements, as expressed more fully in our strategic planning documents, agree and support those of the university and of the college

In keeping with our mission, and in response to the North Central Association's accreditation activities, the Department of Chemical Engineering has prepared this report on our ongoing assessment activities. The report first presents the expected learning outcomes (the knowledge, skills, behaviors, and attitudes) and the assessment tools we intend to use to measure our program's success. We follow with a discussion on faculty and student involvement in the assessment process, and conclude with a timetable for the assessment project

The department is committed to ensuring that our learning goals, the tools with which we measure their achievement, and any curricular or pedagogical changes made as a result of the assessment program must support our goal of diversity and equity

Role of Assessment

The department feels that assessment plays an important role in managing our curriculum We have a systems view of assessment as shown below.

The first part of this method is for the department to develop a series of program objectives/goals based on the input of our various constituents – companies that hire our graduates, graduate schools that enroll our students, professional organizations (ABET and AIChE), our alumni and faculty who teach subsequent courses.

These learning and program objectives will then be implemented into the academic program The students and graduates will then be assessed to see how well the goals are being met. The comparison will then be used by the faculty to improve the academic program and by the various constituents to see if the program objectives need to be modified. In this manner there should be a consistent review of the curriculum in terms of the student learning that will lead to a more tightly integrated curriculum that improves course consistency from term to term.

Learning Goals and Assessment Tools

The department grants BS, MS, and PhD degrees in chemical engineering and a BS in chemical engineering with an emphasis on biochemical engineering. We intend the goals below to apply to all four degree programs; assessment tools specific to graudate degree levels are indicated where appropriate. Measurement tools are noted as "direct" or "indirect" measures, they are currently in place unless noted as "proposed" or "under revision."

Systems View of Assessment

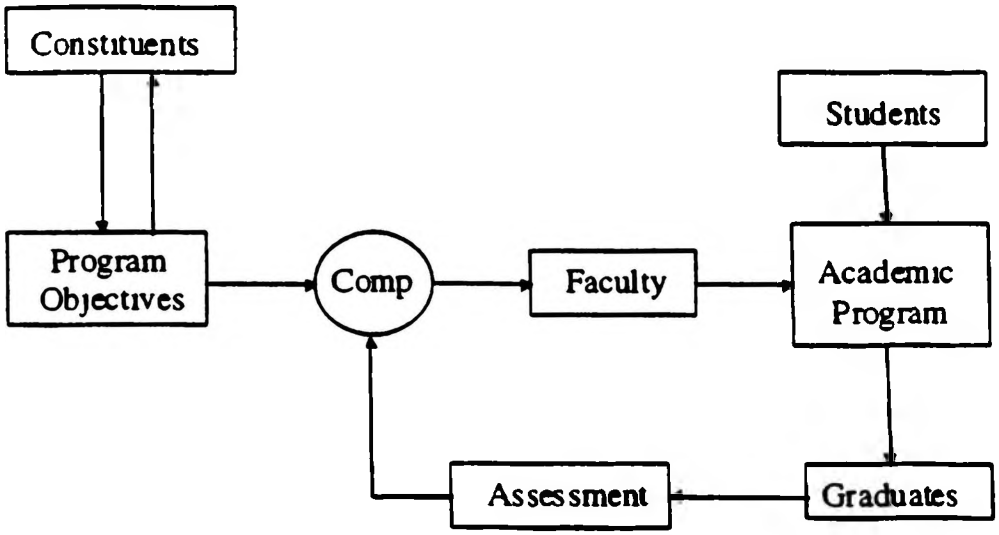


Figure 1 Systems View of Assessment

Goal #1: Students should master chemical engineering fundamentals needed to function as a professional in an appropriate-level engineering position.

Tools:

1. Nationally-normed skills assessment test (FE exam) given to seniors (direct)
2. Evaluation of technical knowledge demonstrated in the required senior capstone project (direct)
3. Information gathered via interview/survey of exiting seniors, targeted specifically to ask about this outcome (indirect; under revision)
4. Performance in required comprehensive exams (direct; MS and PhD)
5. Performance evaluations by graduate advisors (indirect, MS and PhD)

Goal #2: Students should demonstrate the following characteristics needed to tackle new problems and/or technologies: 1) critical thinking; 2) resourcefulness; 3) problem-solving; and 4) research skills.

Tools:

1. Evaluations of solutions to problems (including open-ended) on homework and exams in current courses (direct; for BS and MS students, need to identify/increase)

2. Evaluation of innovation, research, and problem-solving skills demonstrated in required senior design problem (direct) or optional research (390) course
3. Information gathered via survey of alumni two and five years out, targeted specifically to ask about these outcomes (indirect; proposed)
4. Number of peer-reviewed external publications, and presentations and/or posters (indirect; for MS and PhD students)

Goal #3: Students should possess the ability to effectively communicate technical/professional material through written, oral, visual, and graphical forms.

Tools:

1. Evaluation of portfolios which include written material and videos of oral presentation (direct, under revision)
2. Information gathered via survey of alumni two and five years out and their employers, targeted specifically to ask about these outcomes (indirect; proposed)
3. Evaluation of thesis and/or dissertation (direct; for MS and PhD students)
4. Evaluation of graduate student seminar presentations (proposed) and oral exams (indirect; for MS and PhD students)

Goal #4: Students should understand chemical engineer's role in society and the associated responsibility this role carries.

Tools:

1. Evaluation of case study exams covering ethical, global, environmental, safety, and diversity issues (direct; proposed)
2. Test given in required chemical engineering process safety course (direct, proposed)
3. Information from survey of alumni two and five years out; specifically targeted to ask about these outcomes (indirect; proposed)

Discussion/Notes on Assessment Tools

The department recognizes the difficulty of gaining quantifiable, objective data from surveys, and intends to use such data to supplement, rather than drive, curriculum reviews. However, we believe a comprehensive and well-planned survey can provide important supplemental data on student knowledge and performance in all areas addressed.

We also recognize that Goal #4 offers a difficult assessment challenge. However, because of the increasingly global and diverse nature of the chemical process industries and the increased awareness of safety in those industries, we are committed to this goal. Indeed, our current required chemical process safety course is in response to feedback from alumni and industry via our Industrial Advisory Committee. Our current curriculum review and revision seeks to provide students increased emphasis on the areas mentioned (e.g., providing a global/export element in the capstone design course, increased focus on ethics in a number of courses, etc.) while helping faculty find both quantitative and qualitative ways to track student awareness in these areas.

Faculty and Student Input and Involvement in Assessment Activities

This assessment plan has been developed by the department faculty, which is simultaneously reviewing the department's curriculum. Recognizing that they are, in fact, the end-users of our assessment activities, we will ask students to review our assessment plan and provide their comments and suggestions. Such student input led to a restructuring of the course credit hours of the departmental laboratory courses. The laboratory credit hours were increased to more accurately reflect the required time commitment and expectation levels of the laboratories.

Information and results gathered from students, alumni, and employer surveys and from student interviews will be compiled, shared, and discussed with department faculty and, as appropriate, with students. The department has a Web page and we propose expanding its use so that students, faculty, and staff can learn of and discuss information gathered as part of the assessment process.

Timetable for Implementing Assessment Program

Academic Year 1997-98

Analyze the curriculum in terms of instructional units.

Academic Year 1998-99

Refine program objectives, criteria and assessment methods. Refine formal curriculum definition and begin data collection.

Academic Year 1999-00

Data collection.

Academic Year 2000-01

Evaluate criteria assessment methods. Continue data collection

Academic Year 2001-02

Continue data collection. Evaluate criteria and assessment methods. Final preparations for ABET visit.

UNIVERSITY OF MISSOURI - ROLLA

Civil Engineering Department

Academic Outcomes Assessment Program (2/26/99)

A. Mission

To produce leaders in civil engineering capable of understanding the needs and solving problems critical to society relevant to infrastructure and the environment. To provide an educational environment, experiences and support for students and faculty to enable them to contribute to the profession of civil engineering and society by teaching, research and practice. The department will continue to provide comprehensive, forward-looking and broad-based curricula in civil engineering emphasizing fundamentals and practical applications, oral and written communication skills, computer programming and applications skills, and professional practice issues and ethics, which prepare graduates for entry into the profession, for further formal education, and life-long learning and functioning as civil engineers in a global economy.

B. Objectives for Baccalaureate Education

Graduates Will Have:

1. A strong fundamental scientific and technical knowledge base and critical thinking skills which provide the foundation for design, experimentation, interpretation, and analyses, and for life-long learning.

2. The ability to apply engineering skills and work in multi-disciplinary teams to identify and formulate solutions for civil engineering problems, and to analyze and design civil engineering projects.

3 The ability to effectively communicate technical and professional information in written, oral, visual and graphical formats.

4 An awareness and understanding of the moral, ethical, legal and professional obligations needed to function as part of a professional enterprise and to protect human health and welfare, and the environment in a global society.

C. Graduate Education Objectives

1. The masters level curricula in civil engineering and environmental engineering are intended to prepare students for entry at an advanced level of proficiency into engineering practice in the areas of design, operations or research.

Objectives for graduates, in addition to those for Baccalaureate Graduates

a. An in-depth knowledge base and skill level in one or more specialty areas of civil engineering or environmental engineering.

b. The ability to apply engineering skills to significant analysis and design projects and to direct a significant project to its completion.

2. The doctoral curricula in civil engineering is intended to prepare graduates for careers in engineering research, high level engineering practice, or university teaching and research The individual programs emphasize the scholarship of discovery, integration and application.

Objective for graduates, in addition to those for Baccalaureate and Masters Graduates

a The ability to apply engineering skills to discover new knowledge related to a significant engineering problem and to communicate that knowledge and its application to the professional community through publication in refereed professional and research journals.

D. ASSESSMENT TOOLS

Measures to be Utilized for Assessment of Objectives for the Department

1. General Educational Assessment Test (APT).
    a Objective(s) Covered·
        B 1,3
2. Fundamentals of Engineering Exam (EIT).
    a. Objective(s) Covered:
        B 1,2
3. CE 299 Capstone Design Course.
    a. Objective(s) Covered:
        B 1,2,3,4
4. Student Surveys in CE 210, 249 and 299.
    a. Objective(s) Covered:
        B1,2,3,4
5. Opportunities for Employment in Civil Engineering.
    a. Objective(s) Covered:
        B 1,2,3; C 1 a&b, 2 a
6. Employer Surveys.
    a. Objective(s) Covered:
        All
7 Alumni Surveys (2, 5, 15 & 25 years after graduation).
    a. Objective(s) Covered:
        All

E. ASSESSMENT PROCESS

1. Mission: The mission will be continuously reviewed for relevance to Civil Engineering programs, and for agreement with the School of Engineering (SOE) and UMR Missions. Reviews will take place annually, during the Fall Semester, or when Civil Engineering Curricula, SOE mission statement or UMR mission statements are modified. Those involved in this review of the mission, and subsequent approval or modification, include the Civil Engineering Assessment Committee, the Civil Engineering Faculty, and the Civil Engineering Advisory Council. The review process will begin within the Assessment Committee at the beginning of fall semesters, will continue with the Advisory Council review and will end with the review and approval of the Faculty at a December CE Faculty meeting. Changes to the CE mission will require a 2/3 majority vote of the CE Faculty

2. Objectives: Whether the objectives upon which the Civil Engineering Curricula are based continue to be relevant and appropriate will be reviewed annually during the Spring Semester. This review includes gathering of information, analysis of this information and, where necessary, modifications of the objectives. These objectives should be compatible with the mission and be in agreement with ABET Criteria currently published and in force at the time of the review. The Civil Engineering Assessment Committee will gather the information needed and conduct the initial analysis. The Civil Engineering Advisory Council and officers of IDC will be included as the analysis moves toward recommendations. Final recommendations will be approved by the Civil Engineering Faculty in a May CE Faculty Meeting. Changes to these objectives will require a 2/3 majority vote of the CE Faculty.

3. Program: An annual assessment of how well graduates are meeting the objectives will be conducted by gathering the appropriate information as outlined in section D above, analyzing these data to ascertain how they support achieving the objective(s), forming recommendations of how the program can be modified to better achieve the objective(s), and adoption of actions to modify the program. The CE Assessment Committee will gather the information and data and do analyses of how these data support the achievement of the objectives. All CE Faculty and appropriate CE

Students (IDC) will be involved where appropriate in the analysis process. The compilation of analyses results will be presented to the IDC and to the CE Advisory Council for comment, additional information and recommendations. The recommendations of the CE Assessment Committee, CE Advisory Council and IDC officers will be brought to the CE Curriculum Committee. The Curriculum Committee will meet to decide on recommended changes, if needed, to the CE curricula. The CE Faculty will review the recommendations, develop recommendations and adopt changes to the program as needed. Changes to the curriculum will be established by the end of each Fall Semester to enable inclusion in the subsequent Fall Semester. Changes to the CE Curricula will require a 2/3 majority vote of the CE Faculty.

While it would desirable for each graduate to exemplify the highest of performance in each objective, it is recognized that a reasonable level should be specified. The standard of measure shall be that 90% of all graduates will have attained at least an acceptable level of performance of each objective as determined by the type of criteria measurement tool utilized.

4. Assessment Process: The processes utilized as stated above will be reviewed by the CE Faculty on a Tri-Annual basis during the Spring Semester. Revisions to the processes shall require a 2/3 majority vote of the CE Faculty.

Matrix of Assessment Tools and Objectives of Programs - Civil Engineering, UMR

Tool > Objective V	APT Exam	FE Exam	CE 299 Perform.	Student Surveys	Opportunities for Employment	Alumni Surveys
Fundamental Science and Technical Knowledge	X	X	X	X	X	X
Applying Skills in Design Teams		X	X	X	X	X
Communi-cation	X		X	X	X	X
Ethical Legal Professional		X	X	X		X
Specialty Knowledge			X	X	X	X
(Masters) Project					X	X
(Doctors) New Knowledge					X	X

Synopsis of Civil Engineering Survey of Faculty Experiences with Assessment

A Survey of the Civil Engineering faculty was conducted early in 1999 to determine their experiences with assessment type processes used for course improvements. The following is a compilation of these experiences.

The survey response was from about one-half the faculty. The first two questions had to do with surveys of students in individual courses. Five of the eight faculty have utilized beginning of course surveys and one had conducted end of course surveys. Beginning of course survey results have been used to know student expectations, to have students reflect on their state of preparation in areas which are prerequisites for the course, to aid in pacing the course for the students in the class, to determine what teaching-learning style works best for the students and to better know how to approach the course material for the students in the class. The end of course surveys were used to determine how well the course met student expectations and to evaluate the text and teaching methods used in the course.

These faculty have used standard student evaluations to improve their courses and teaching techniques. They have looked at the responses concerning the ways materials were presented, the amount of homework assigned, providing better examination material, the quality of the text used and areas of needing improvement and developing a plan for the next term. Their aim is to interpret what is said so as to optimize how each course is presented and the amount of material to be covered.

Six of the eight faculty indicated that they thought a particularly low student average for the course indicated that either the course presentation or examinations could be the problem. They believe that test averages are an indicator of attainment of teaching goals and exam quality. Some believe that looking at students who are expected to perform well, based on past performance, aids in determining whether the problems are student oriented or course-examination oriented.

The faculty responding had expectations that the student average scores would be between 70 and 80. In addition, their expectations were higher for upper class people, than for sophomores. Faculty also reported using statistical analyses to look at grade distributions to assist in understanding how they indicate the quality of the learning environment and testing.

When discussing other measures and techniques which had been used for assessment, the faculty had several interesting responses. They have talked to students outside the classroom, after student professional society meetings, etc. They have used general student feedback, both directly and indirectly heard. They have used the quality of homework as an indicator of learning. Recently, they have used communication by email a great deal more. Faculty have been noticing the type of questions asked and student difficulties expressed as indicators of the quality of the learning experience. More than one of the faculty are calculating the percentages of right answers on exams in each category of the established learning objectives of courses and adjusting their teaching/learning environment and course progress to improve overall performance.

There has been for several years a process of using student surveys in two classes taken by seniors These are the senior seminar and the course covering professionalism and ethics. In each case students are surveyed each semester to obtain their views on the curriculum, faculty, advising and courses These survey results are provided to the department chairman, who brings up general items at faculty meetings and individual items during yearly faculty reviews. Over the space of a few years we have seen faculty improvement and closer department-student interaction because of these surveys. One of the reasons that the CE faculty committee is currently working on improvements to the curriculum is the student feedback from these surveys.

Assessment in the Department of Electrical & Computer Engineering

A. Mission

The mission of the Department of Electrical and Computer Engineering is to produce leaders in Electrical and Computer Engineering that can contribute to the solution of our society's problems in computers and computer networks, electrical power and machinery, communications and digital signal processing, control and automation, electronic materials, electro-optics, electromagnetic compatibility and electronic circuits. A key to achieving this mission is to provide an environment conducive to learning, creativity, and service for faculty, staff and students of all races, national origins, genders and religions Graduates must be exposed to up-to-date curricula that address areas such as the necessary foundation in mathematics and basic science, communications (oral and written), engineering sciences, design, ethics, the need for life-long learning and the responsibilities incumbent on a practicing engineer in a global economy.

B. Program Outcomes - Undergraduate

Students graduating from the BS programs in Electrical & Computer Engineering should have
(a) an ability to apply knowledge of mathematics, science, and engineering.
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.
(c) an ability to design a system, component, or process to meet desired needs.
(d) an ability to function on multi-disciplinary teams.
(e) an ability to identify, formulate, and solve engineering problems
(f) an understanding of professional and ethical responsibility.
(g) an ability to communicate effectively
(h) the broad education necessary to understand the impact of engineering solutions in a global and societal context.
(i) a recognition of the need for, and an ability to engage in life-long learning.
(j) an knowledge of contemporary issues
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice
(l) an ability to apply advanced mathematics through multivariate calculus and differential equations
(m) familiarity with statistics and linear algebra
(n) an ability to apply concepts from systems engineering, such as Fourier, Laplace, Z-transform and other methods of complex domain analysis.

Program Outcomes - Graduate

M.S.
In addition to the expectation for B S students, students graduating from this program should have
(a) a mature knowledge base in the fundamentals of Electrical or Computer Engineering
(b) an in-depth knowledge base and skill level in one or more specialty areas of Electrical or Computer Engineering
(c) the ability to apply engineering skills to significant analysis and design projects, and to direct a significant project to its completion.
(d) the ability to communicate scientific results in writing and oral presentation

Ph.D.
In addition to the expectons for the M S. students, students graduating from this program should have

(a) the ability to apply engineering skills to discover new knowledge related to a significant engineering problem.
(b) the ability to communicate new knowledge and its application to the professional community through publication and presentation in a professional setting

D. Assessment Tools

Measures to be Utilized for the Assessment of Objectives for the Department of Electrical & Computer Engineering

1 General Educational Assessment Test (the Academic Profile Test or APT)
(a) Objectives covered
B b, c, g, i, k, l, m, n

2 Fundamentals of Engineering Exam (FE)
(a) Objectives covered
B a, b, c, d, e, i, k, l, m, n

3 EE 391 and 392/Cp Eng 391 and 392 - Senior Project I & II
(a) Objectives covered
B g

4 Student Surveys in EE210/Cp Eng 210 - Senior Seminar
(a) Objectives covered
B. a, b, c, d, e, f, g, h, i, j, k, l, m, n

5 Opportunities for Employment in Electrical and Computer Engineering
(a) Objectives covered
B a, b, c, d, e, f, h, i, j, k, l, m, n
C MS a, b, c, d; Ph.D. a, b

6 Employer Surveys
(a) Objective covered
All

7 Alumni Surveys (2, 5, 15 & 25 years after graduation)
(a) Objectives covered
All

E. Assessment Process

1 Mission. The mission will be continuously reviewed for relevance to the Department of Electrical & Computer Engineering programs, and for agreement with the School of Engineering (SOE) and UMR Missions Reviews will take place annually, during the Fall Semester, or when Electrical & Computer Engineering Curricula, SOE mission statement or UMR mission statements are modified Those involved in this review of the mission, and subsequent approval or modification, include the Electrical & Computer Engineering Assessment Committee, the Electrical & Computer Engineering Faculty, and the Electrical & Computer Engineering Academy The review process will begin within the Assessment Committee at the beginning of Fall semesters, will continue with the Academy review and will

end with the review and approval of the Faculty at a Winter Semester ECE Faculty meeting. Changes to the ECE mission will require a 2/3 majority vote of the ECE Faculty.

2 Objectives. Whether the objectives upon which the Electrical & Computer Engineering Curricula are based continue to be relevant and appropriate will be reviewed annually during the Winter Semester. This review includes gathering of information, analysis of this information and, where necessary, modifications of the objectives. These objectives should be compatible with the mission and be in agreement with ABET Criteria currently published and in force at the time of the review. The Electrical & Computer Assessment Committee will gather the information needed and conduct the initial analysis The Electrical & Computer Engineering Academy will be included as the analysis moves toward recommendations. Final recommendations will be approved by the Electrical and Computer Engineering Faculty in a Winter Semester ECE Faculty Meeting Changes to these objectives will require a 2/3 majority vote of the ECE Faculty

3 Program. An annual assessment of how well graduates are meeting the objectives will be conducted by gathering the appropriate information as outlined in Section D above, analyzing the data to ascertain how they support achieving the objective(s), forming recommendations of how the program can be modified to better achieve the objective(s), and adoption of actions to modify the program. The ECE Assessment Committee will gather the information and data and do analyses of how these data support the achievement of the objectives. All ECE Faculty and appropriate ECE students (IEEE & HKN officers) will be involved where appropriate in the analysis process. The compilation of analyses results will be presented to the ECE Academy for comment, additional information and recommendations. The recommendations of the ECE Assessment Committee, ECE Academy and IEEE/HKN officers will be brought to the ECE Curriculum Committee.. The Curriculum Committee will meet to decide on recommended changes, if needed, to the ECE curricula. The ECE Faculty will review the recommendations, develop recommendations and adopt changes to the program as needed. Changes to the curriculum will be established by the end of each Fall Semester to enable inclusion in the subsequent Fall Semester Changes to the ECE Curricula will required a 2/3 majority vote of the ECE Faculty

While it would be desirable for each graduate to exemplify the highest of performance in each objective, it is recognized that a reasonable level should be specified. The standard of measure shall be that 90% of all graduates will have attained at least an acceptable level of performance of each objective as determined by the type of criteria measurement tool utilized.

4 Assessment Process The processes utilized as stated above will be reviewed by the ECE Faculty on a Tri-Annual basis during the Winter Semester Revision to the processes shall require a 2/3 majority vote of the ECE Faculty

Engineering Management Department
Academic Outcomes Assessment Program

Mission:

To provide leaders in Engineering Management capable of solving problems through systems integration at the interface of technology and management. These capabilities include designing, analyzing, implementing, operating, and optimizing systems for industry, government, and the military.

Baccalaureate Degree Goals:

B1) Graduates having a solid foundation in and the ability to apply the principles of engineering science, mathematics, and statistics
B2) Graduates having a fundamental knowledge of a broad core of business knowledge concerning management, organization behavior, accounting, finance, engineering economy, and marketing.
B3) Graduates having a specialized expertise in either management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering
B4) Graduates having a commitment to continuous self-improvement and the capability to function responsibly in a global society as effective communicators and team players

Graduate Degree Goals:

G1) Masters candidates from other undergraduate engineering programs who are attempting to broaden their education to include management are considered within the Baccalaureate Degree goals B2, B3, and B4.
G2) Masters candidates seeking to specialize should have an in-depth knowledge and skill in one or more of the management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering specialties, in addition to the Baccalaureate Degree goals
G3) Doctoral candidates are seeking high level careers in engineering, management, or university teaching and research. They should have the ability to discover new knowledge concerning a significant engineering management problem and to share that knowledge with the professional community.

Assessment Tools: The sources of assessment data for the department are listed here The objectives served by the assessment tool are noted along with a statement explaining the use of the tool in evaluating our degree programs

1) General Education Test (APT)

B1· The APT is administered by the UMR Assessment Office to incoming freshmen The test results help us to understand whether our undergraduates have a solid foundation in the principles of engineering science, mathematics, and statistics

2) Fundamentals of Engineering Exam

B1. Seniors are requested to take the EIT exam The test results help us to understand whether our undergraduates have a solid foundation in and the ability to apply the principles of engineering science, mathematics, and statistics

B2 Seniors are requested to take the EIT exam The test results help us to understand whether our undergraduates have a fundamental knowledge of engineering economy

B3 Seniors are requested to take the EIT exam The test results help us to understand whether our undergraduates have a fundamental knowledge of industrial engineering

3) Capstone Courses

B2 The management core courses required of all undergraduates have EMgt 260 General Management-Design and Integration as their capstone course This course attempts to integrate the material from the management core. Performance in this course is an indication of whether our undergraduates have a fundamental knowledge of a broad core of business knowledge concerning management, organization behavior, accounting, finance, engineering economy, and marketing.

B3· The following capstone courses are identified for each of the specialized areas within the department: Management of Technology (EMgt 320 Technical Entrepreneurship), Quality Control (EMgt 387 Experimentation in Engineering Management), Industrial Engineering (EMgt 257 Plant Layout and Materials Handling), Packaging Engineering (EMgt 388 Packaging System Design), and Manufacturing Engineering (EMgt 344 Industrial Problems in Industrial Automation) These courses attempt to integrate the material within their respective specialty area Performance in these courses is an indication of whether our undergraduates have a specialized expertise in either management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering

B4 All capstone courses noted in this section are opportunities to assess whether our undergraduates have a commitment to continuous self-improvement and the capability to function responsibly in a global society as effective communicators and team players

G1 Graduate students are encouraged to enroll in EMgt 441 Case Studies in General Management as a course which integrates management concepts or EMgt 454 Advanced Production Management as a course which integrates manufacturing concepts Performance in these courses allows us to consider whether graduate students are achieving the results identified in objectives B2, B3, and B4

G2 Graduate students pursuing a specialty area would be expected to take the same capstone courses identified in the discussion for B3 in this section above Their performance in these courses is an indication of whether our graduate students have a specialized expertise in either management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering

4) Student Survey

B1,2,3,4 G1,2,3 A survey is administered to all students before graduation in which students are asked to comment on their experience within the department Results of the survey may bear on any departmental objective

5) Opportunities for Careers in Engineering Management

B1: Analysis of the career opportunities available to undergraduates is an indication of whether companies consider our graduates to have a solid foundation in and the ability to apply the principles of engineering science, mathematics, and statistics Analysis of student career opportunities includes their ability to gain graduate school admission
B2: Analysis of the career opportunities available to undergraduates is an indication of whether companies consider our graduates to have a fundamental knowledge of a broad core of business knowledge concerning management, organization behavior, accounting, finance, engineering economy, and marketing. Analysis of student career opportunities includes their ability to gain graduate school admission.
B3: Analysis of the career opportunities available to undergraduates is an indication of whether companies consider our graduates to have a specialized expertise in either management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering Analysis of student career opportunities includes their ability to gain graduate school admission
G1. Analysis of the career opportunities available to graduate students is an indication of whether companies consider our graduate students to have the preparation identified in objectives B2, B3, and B4.
G2 Analysis of the career opportunities available to graduate students is an indication of whether companies consider our graduate students to have a specialized expertise in either management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering.
G3 The positions available to our doctoral graduates is an indication of whether companies and universities consider our doctoral graduates to be prepared to discover new knowledge concerning a significant engineering management problem and to share that knowledge with the professional community

6) Alumni Surveys

B1,2,3,4 G1,2,3 A survey is administered to alumni in which they are asked to comment on the quality of the degree programs in preparing them for their careers Results of the survey may bear on any departmental objective

7) Industrial Advisory Council

B1,2,3,4 G1,2,3 The Industrial Advisory Council meets annually to review developments within the department Comments generated in these meetings may bear on any objective.

8) Professional Society Participation

B4 Students are encouraged to participate in professional societies as student members Observations made by faculty advisors of student performance in the societies is an indication of their commitment to continuous self-improvement and their capability to function responsibly in a global society as effective communicators and team players

9) Qualifying Exams

G1: The results of Comprehensive Exams administered to graduate students are an indication of their preparation according to the Baccalaureate Degree goals B2, B3, and B4

G2: The results of Comprehensive Exams administered to graduate students and Thesis Defenses are an indication of their in-depth knowledge and skill in one or more of the management of technology, quality control, industrial engineering, packaging engineering, or manufacturing engineering specialties, in addition to the Baccalaureate Degree goals B2, B3, and B4

G3 The results of Qualifying and Comprehensive Exams administered to graduate students and Dissertation Defenses are an indication of their ability to discover new knowledge concerning a significant engineering management problem and to share that knowledge with the professional community

Assessment Process: The regular activities within the department for reviewing our mission statement, for reviewing our objectives, for carrying out degree program evaluation, and for reviewing the entire assessment process itself are described here.

1) Mission: The Engineering Management Department Mission Statement will be reviewed for continued relevance to existing department objectives and degree programs, and for agreement with the School of Engineering and UMR mission statements Reviews will be conducted annually or when department objectives, School of Engineering Mission Statement, or UMR Mission Statement changes occur. Changes recommended by the Engineering Management Department Assessment Committee will be submitted to Engineering Management Department Faculty for approval

2) Objectives: The objectives will be reviewed for relevance to the Engineering Management Department Mission Statement and existing degree programs, and for agreement with the School of Engineering and UMR mission statements Reviews will be conducted when department program changes are proposed or when departmental, School of Engineering, or UMR mission changes occur. Changes in objectives recommended by the Engineering Management Department Assessment will be submitted to Engineering Management Department Faculty for approval

3) Degree Program Evaluation The evaluation of how well department programs meet department objectives will be conducted by the Engineering Management Department Assessment Committee according to the following steps
   - Apply the Assessment Tools.
   - Assemble the Assessment Data for Evaluation
   - Evaluate the Assessment Data annually to understand how well Degree Programs are achieving Department Objectives
   - Formulate Action Plans for correcting deficiencies and for carrying out improvements suggested by the Evaluation of the Assessment Data
   - Present the results to the Engineering Management Department Faculty for further discussion and Final Approval of the Action Plans

4) Assessment Process: The effectiveness of the assessment process, and especially the usefulness of the assessment tools, will be reviewed annually by the Engineering Management Department Assessment Committee and submitted to Engineering Management Department Faculty for discussion

Mechanical Engineering Assessment Plan
(Updated Feb 19, 1999)

Introduction
The Department of Mechanical and Aerospace Engineering and Engineering Mechanics has a long history of continual assessment and improvement of our programs and curriculum There is substantial and consistent evidence, particularly from our alumni and employers of our graduates, that the results of the process have been excellent. Recent focus has been on better defining the assessment process, providing a framework for improved evaluation and documentation. This Assessment Plan has been prepared for the Mechanical Engineering program, including both undergraduate and graduate degrees. It is designed to provide practically useful information and procedures for continual improvement of the ME program, while simultaneously providing documentation for accrediting agencies.

M&AE&EM Vision Statement

To build and enhance the excellent public program that the Department of Mechanical and Aerospace Engineering and Engineering Mechanics currently is, and to be recognized as such,

To provide our students with experiences in solving open-ended problems of industrial and societal need through learned skills in integrating engineering sciences, and synthesizing and developing useful products and processes;

To provide experiences in leadership, teamwork, communications — oral, written and graphic —, and hands-on activities, with the help of structured and unstructured real-life projects

Program Educational Objectives

Statement of Program Educational Objectives

The following Educational Objectives represent the broad objectives of this department as they relate to the students.

Undergraduate

1. To provide students with a solid foundation in the fundamental principles of science and engineering.
2. To examine current and relevant technical problems in engineering as examples of the applications of such principles.
3. To provide comprehensive course work in both the thermal and mechanical systems areas, including cross-linkage between the two areas.
4. To provide students with meaningful design experiences.
5. To provide students with opportunities to develop teamwork, communication, and computer skills.

M S

1. To prepare students for entry at an advanced level of proficiency into engineering practice.
2. To prepare students for entering a Ph.D. program of study.

Ph D

1. To prepare students for entry into research engineering practice.
2. To prepare students for entry into the academic community

Relation of Program Curriculum to Objectives

In this section, it will be shown how elements in the Mechanical Engineering curriculum address the objectives specified above.

Undergraduate

Objective 1

The early part of the curriculum focuses on the foundational sciences, e.g. with 33 credit hours of Chemistry, Math, and Physics. A grade of C or better is required in many of these courses, reflective of the necessity to be well grounded before moving into further application of the principles involved. At each stage, previously developed principles are applied in developing new concepts, e.g. physics uses a calculus based approach, dynamics builds on a vector and calculus basis. The entire prerequisite sequencing is designed to provide a foundation, then build on it with application. Specific examples include the sequences of Chemistry to Metallurgy to Mechanics of Materials to Machine Design, or Chemistry to Thermodynamics to Applied Thermodynamics.

Objective 2

Part of the objective in each course is to demonstrate applications of the principles. Many follow-up courses specifically are designed to provide more depth in application of the principles previously covered, e.g. Machine Dynamics as a follow-up for Dynamics, Applied Thermodynamics for Thermodynamics, Controls lab for Controls, ME Systems Lab for most of the previous courses. The capstone design course is the final example of applying the previously developed principles to realistic problems, many of which are derived in cooperation with industrial sponsors. Outside of the coursework, industrial speakers are hosted by the numerous student sections of professional organizations, providing 6 to 10 opportunities in each semester to see relevant technical problems presented.

Objective 3

In the thermal/fluids areas, the curriculum includes Thermodynamics, Applied Thermodynamics, Heat Transfer, Fluid Mechanics, as well as numerous electives. In the mechanical systems areas, required courses beyond the fundamental principles level include Machine Dynamics, Machine Design, Mechanical Instrumentation Lab, Controls, and Controls Lab. There is by nature some cross-linkage even within these courses, primarily through use of realistic example problems. Further cross-linkage is ensured through the labs, especially the Mechanical Systems lab, and the capstone design project.

Objective 4

Design experiences begin at the Freshman level with EG 10, Engineering Design with Computer Applications, continue at the Sophomore level with ME 161, Introduction to Design, and continue throughout to a conclusion with the capstone project in ME 261, Analysis and Synthesis in Engineering Design. Each of these provide open-ended, group oriented experiences in design and analysis. The capstone projects are often sponsored by industry, and are evaluated at mid-semester and at the end of the semester by a panel of industrial representatives.

Objective 5

Teamwork and communication skills are in many aspects developed through the same avenues as described in Objective 4 for group design experiences. In addition, the curriculum includes a communication elective, as well as two labs which have been designated as "writi g intensive." The ME 242 lab also includes a formal, peer and faculty evaluated oral technical presentation Co-curricular opportunities for developing teamwork and communication skills include various competitive design teams, professional and honor society activities, intercollegiate written and oral presentation competitions, etc. Various computer application skills are introduced to Freshmen in EG 10, Engineering Design with Computer Applications, followed by a programming course at the sophomore level. Practically all Junior and Senior courses require use of computers in the assignments, including word processors, spreadsheets, math solvers, simulation software, programming, graphic presentation of data, technical presentation, and computer drawings

Graduate

At the M S level, all students are required to enroll in a core curriculum that ensures an advanced understanding of all fundamental areas of mechanical engineering. Additionally, all students are required to enroll in a minimum of 6 hours of thesis research and to produce a thesis at the end of their program. Not only does this requirement ensure an advanced competency in a specific area but it prepares those considering pursuing a Ph.D

At the Ph.D level, 60 course hours are required beyond the B S to help the student develop an advanced understanding of engineering fundamentals. Verbal communication and teaching skills are reinforced through an oral (and written) comprehensive exam along with an oral dissertation defense. Opportunities are provided to students to serve as graduate teaching assistants to further strengthen teaching skills. Publishing of research results is strongly encouraged throughout a student's program.

Program Outcomes

Statement of Program Outcomes

Undergraduate

Students graduating from this program should have

(a) an ability to apply knowledge of mathematics, science, and engineering
(b) an ability to design and conduct experiments, as well as to analyze and interpret data.
(c) an ability to design a system, component, or process to meet desired needs
(d) an ability to function on multi-disciplinary teams.
(e) an ability to identify, formulate, and solve engineering problems.
(f) an understanding of professional and ethical responsibility.
(g) an ability to communicate effectively.
(h) the broad education necessary to understand the impact of engineering solution in a global and societal context.
(i) a recognition of the need for, and an ability to engage in life-long learning
(j) a knowledge of contemporary issues.
(k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.
(l) a knowledge of chemistry and calculus-based physics, with depth in at least one
(m) an ability to apply advanced mathematics through multivariate calculus and differential equations

(n) familiarity with statistics and linear algebra.
(o) an ability to work professionally in both thermal and mechanical systems areas including the design and realization of such systems.

M S
In addition to the expectations for B.S. students, students graduating from this program should have
(a) an advanced knowledge base in the fundamentals of Mechanical Engineering
(b) an ability to apply advanced knowledge in one or more specialty areas of Mechanical Engineering.
(c) the ability to direct a significant project to its completion.
(d) the ability to communicate scientific results in writing and oral presentation

Ph.D
In addition to the expectation for the M.S. students, students graduating from this program should have
(a) the ability to apply engineering skills to discover new knowledge.
(b) the ability to communicate new knowledge to the professional community

Relation of Outcomes to Educational Objectives

Undergraduate

In a broad sense, all of the O tcomes are interconnected with one another and with each of the Educational Objectives. Each Educational Objective can be clearly associated with at least one Outcome, while each Outcome is usually derived from multiple Objectives. The following correlation is intended to provide a basis for demonstrating a relation between the Educational Objectives and the Outcomes.

Objective 1: Outcomes a, b, i, l, m, n
Objective 2. Outcomes e, f, h, j, k, o
Objective 3: Outcomes o, k, b, c, d
Objective 4: Outcomes c, e, o, a
Objective 5: Outcomes d, g, b, f, k

Graduate

At the M.S. level, advanced study of both the fundamentals of Mechanical Engineering as well as in a specialty area is necessary to have an advanced proficiency in the field. The direction of a significant technical project in addition to the ability to communicate the results allow the student to move more easily into an engineering field which traditionally requires such abilities. These also prepare a student for dissertation work at a Ph.D. level.

At the Ph.D. level, demonstration of the ability to discover new knowledge, whether this be new principles, concepts or methods, is key to entry into the field of research. The research may be in the academic, industrial or national lab setting. In any of these settings, effective communication of research findings to peers and industry is vital

Processes to Assure Achievement of Outcomes

Assessment Tools

It is desired to have each Outcome measured by multiple assessment measures The Department already has in place several assessment instruments. Many of these instruments are by nature indirect measures, or indicators, of the Outcomes. Due to the ease of implementation, these indirect measures are still considered useful when verified by multiple measures and when appropriately evaluated for significance. If several indirect measures indicate a potential problem, then more direct assessment instruments may be

designed to provide better data. Many of the surveys which are currently used have been developed over time and modified periodically to seek information of current interest. As the current assessment process matures, assistance from the Office of Academic Assessment will be solicited to further tune the survey questions to correlate with the desired Outcomes to be measured. Current assessment tools are described below.

Undergraduate

1 Pass rate from Fundamentals of Engineering Exam, as well as performance on specific sections of the exam.
Pertinent Outcomes: a, e, i, k, l, m, n, o
2 Alumni surveys.
Pertinent Outcomes. All
3 Industrial surveys.
Pertinent Outcomes: All
4 Graduating Senior surveys.
Pertinent Outcomes: All
5 Student body surveys.
Pertinent Outcomes: All
6 Assessment of capstone design projects by faculty and Academy.
Pertinent Outcomes: a, b, c, d, e, f, g, h, k, o
7 Performance in certain key courses.
Pertinent Outcomes: a, b, l, m, n
8 Direct feedback from Industrial Advisory Committee.
Pertinent Outcomes: All
9. Direct feedback from Academy of Mechanical Engineers.
Pertinent Outcomes: All
10. Involvement in Professional, Honor, or Service organizations
Pertinent Outcomes: f, g, h, i, j
11 Academic Profile Test
Pertinent Outcomes: a, e, h, i
12. Feedback from ABET review
Pertinent Outcomes: All

Graduate

1. Alumni surveys.
2. Requirement to maintain a 3.0 or greater grade average in upper level courses.
3 Acceptance of thesis (M.S.) or dissertation (Ph.D.) written report by the student's thesis or dissertation committee.
4 Approval of oral defense at both M.S. and Ph.D level.
5 Acceptance of papers and presentations in professional journals and conferences

Performance Criteria

Undergraduate

While it is desirable for each student to completely satisfy each Outcome, it is recognized that a reasonable level should be targeted for acceptable performance criteria. As a general guideline, at least 90% of students graduating from this program should have achieved each Outcome. This guideline can readily be used as a performance criteria for any direct assessment measure. For indirect measures, a potential weak performance area will be identified by any assessment result which is not significantly above the average of comparable programs, or above an average rating of "good" on a survey rating. Any assessment measure which declines over time will also be indicative of a potential weak performance area.

Graduate

At the M.S. and Ph.D. level, alumni surveys will be distributed to assess past students' perception of the effectiveness of the advanced study in preparing the student for engineering practice or pursuit of further advanced degrees. Given a range of "poor" to "excellent", an average response of "good" is desired. Acceptance of the thesis/dissertation and of the oral presentation by the thesis committee will be reported by the student's thesis/dissertation committee to the department and the Dean's Office Acceptance of thesis/dissertation and oral defense by the student's committee will be required for graduation. The requirement to maintain a 3 0 or greater grade average will be monitored by the department. Minimum desired performance levels for papers and presentations are acceptance of one refereed conference paper for a M.S. student and two journal articles for a Ph.D. student.

Assessment Processes

Significant Constituencies

The significant constituencies of this program are the faculty, staff, students, parents, employers, and alumni. These are the groups of people who have specific reason to be concerned with the welfare of this program, and who should therefore be included in the information channels.

Processes for Establishing Objectives

Initial objectives for the undergraduate degree program were established by the department Curriculum committee. Evaluation and feedback was solicited from the constituencies, particularly the faculty, students, and industrial advisors. Final approval was by the department faculty. Responsibility for regular re-evaluation of the objectives lies with the department Curriculum committee, and is expected to take place every three years. Graduate degree objectives are primarily maintained by the graduate committee.

Feedback Processes

Evaluation

The Associate Chair of Mechanical Engineering has the primary responsibility for ensuring the assessment data is critically evaluated in a timely and regular manner The department Curriculum Committee, which is chaired by the Associate Chair of Mechanical Engineering and consists of representatives from each of the department technical committees, has the primary responsibility for identifying weak performance areas and tracking changes in previously identified weak performance areas. This committee will also continually seek to improve the assessment tools as necessary to better measure the Outcomes.

The Associate Chair for Graduate Affairs has the primary responsibility for ensuring the assessment data is obtained in a timely and regular manner for the graduate program. The department Graduate Committee, which is chaired by the Associate Chair for Graduate Affairs, has the primary responsibility for identifying and proposing to the faculty any changes to address weak performance areas.

Action Items

The Curriculum Committee will report evaluation results to the faculty of the department. The Committee may recommend specific Action Items to address areas of weak performance. The faculty of the department has the ultimate responsibility to identify and approve specific Action Items to be pursued. The Department Chair has the responsibility to assess work loads and assign tasks to appropriate individuals or committees accordingly. The Associate Chair of Mechanical Engineering has the

responsibility to track the progress of each Action Item to its completion. The Department Chair has the responsibility to include the Action Items in the budget process.

Similarly, for the Graduate Program, the Graduate Committee will recommend to the faculty specific Action Items to address areas of weak performance. The faculty of the department has the ultimate responsibility to identify and approve specific Action Items to be pursued. The Associate Chair for Graduate Affairs has the responsibility to track the progress of each Action Item to its completion. The Department Chair has the responsibility to include the Action Items in the budget process.

Accountability

The assessment data will be published and made available upon request to any of the constituencies of the program. Meetings of the Curriculum Committee will be open to representatives of any of the constituencies. Once each year, the Associate Chair of Mechanical Engineering will issue a written report, to be made readily available to all of the constituencies of the program, which summarizes the status and progress of the Action Items which are currently active. An Action Item will remain active until it is either reported as accomplished or it is rescinded by the department faculty

For the Graduate Program, the assessment data will be made available upon request to any of the constituencies of the program. Meetings of the Graduate Committee will be open to representatives of any of the constituencies. Once each semester, the Associate Chair for Graduate Affairs will issue a written report, to be made readily available to all of the constituencies of the program, which summarizes the status of the graduate program.

Implementation Time Table

Academic Year 1998-99

Define and refine the assessment process, objectives, outcomes, and assessment methods. Obtain feedback from constituents on the Assessment Plan. Evaluate assessment data to determine needed improvements in assessment instruments to better correlate with the desired Outcomes to be measured.

Academic Year 1999-00

Refine survey instruments. Collect assessment data. Evaluate data and define Action Items

Academic Year 2000-01

Implement Action Items. Continue to refine the process while collecting data, evaluating data, and defining new Action Items.

Examples of Recent Modifications

Most of the assessment tools previously described have been used for some time in influencing appropriate modifications to the Mechanical Engineering curriculum. This Assessment Plan reflects an effort to clarify and enhance the process through more deliberate and documentable steps. Since the implementation of this plan is yet in its early stages, documentable evidence of direct correlation between assessment information and curriculum modifications is limited. However, in order to demonstrate a history of responding to assessment information in a way which is compatible with the newly defined assessment plan, several recent curriculum modifications are described below.

Assessed Weakness:	Students were generally weak in written communication skills
Relevant Outcomes:	g
Assessment Sources:	Industrial surveys, assessment of capstone design report, faculty observation
Action Taken.	Increased involvement of Writing Across the Curriculum faculty and facilities in ME 240 and ME 242. Writing handbook added to ME 242 manual. Added re-write assignment in ME 242. Provide workshop for GTA graders of lab reports each semester
Assessed Weakness:	Students were weak in designing and interpreting experiments.
Relevant Outcomes.	b
Assessment Sources:	Observation in ME 240 and ME 242.
Action Taken:	Added "extension" experiment in ME 242 where students define objectives and design experiment to investigate. Lab Committee initiated discussion of major modifications to lab courses to minimize "cook book" approach. Modifications are pending
Assessed Weakness:	Low student satisfaction with their input to department activities
Relevant Outcomes.	j, i, g, f
Assessment Sources:	Senior exit interviews, anecdotal student contacts
Action Taken:	Initiated annual open forum sessions to present current curriculum issues and receive input from students. Initiated department email listserv to improve regular communications.
Assessed Weakness:	Weak performance on Engineering Economics topics on EIT exam
Relevant Outcomes:	h, k, n
Assessment Sources:	EIT exam results, Senior exit interviews
Action Taken:	Added required course in Engineering Economy and Management
Assessed Weakness:	Weak performance on Fluids topics on EIT exam
Relevant Outcomes.	a, e, o
Assessment Sources:	EIT exam results
Action Taken:	Modified content of Fluids course to incorporate more design and applications oriented material.
Assessed Weakness:	Need for more open-ended design experiences.
Relevant Outcomes:	a, c, e, o
Assessment Sources:	ABET documentation, industrial surveys
Action Taken.	Open-ended homework assignments and projects were added to most classes. ME 161, Introduction to Design, was created to provide a group design experience at the Sophomore level. A significant design project was added to ME 208, Machine Design

Assessed Weakness.	Students had become weaker in engineering drawing skills, particularly when the Freshmen curriculum replaced much of the drafting course with computer and design content.
Relevant Outcomes:	g, k
Assessment Sources	Instructor observations, especially in ME 161 and ME 261, senior exit surveys, direct industrial feedback.
Action Taken.	An ad hoc committee was formed to study the situation and to recommend modifications, particularly focusing on the content of ME 161. Proposed modifications are pending approval by department.

Assessed Weakness:	Many of the capstone design experiences concluded with unrealistic results.
Relevant Outcomes:	c, e, f, g, j, o
Assessment Sources:	Evaluation of capstone design projects.
Action Taken:	A panel of industrial representatives provide a mid-semester review of each project, and also evaluate the final project presentation.

Assessed Weakness	Many students were weak in foundational preparation for some of the Junior and Senior level courses.
Relevant Outcomes.	a, l, m
Assessment Sources	Instructor observation of homework and exam performance.
Action Taken	Required a grade of C or better in certain key prerequisite courses

Objectives, Evaluation Questions and Measures of the Ceramic Engineering Program

Program Objectives	Evaluation Questions	Evaluation Measures / Outcomes
1. Balanced, detailed modern curriculum	♦ How often do the faculty meet to discuss curricula ? ♦ What courses have been updated this year ? ♦ What new courses have been added this year ? ♦ What courses have been updated this year ? ♦ Have the faculty participated in programs designed to improve teaching effectiveness ?	♦ Number & quality (as measured by the student course/teacher evaluation (CTE)) of courses updated ♦ Number & quality (CTE) of new courses ♦ Student satisfaction as measured with the course evaluation forms. ♦ # faculty participating in teaching improvement courses
2. Recruiting students of superior ability, as demonstrated by a their gpa, ACT, SAT. Attracting minority & underrepresented students.	♦ Did the faculty participate in the Jackling I & II program ? ♦ Did the faculty participate in Freshman Engr. ? ♦ Did the faculty participate in University Day and Parent's Day ? ♦ Did the faculty assist in local outreach programs ? ♦ Does Ceramic Engineering have a home page on the WWW ? ♦ Are brochures, posters, and application forms generated for the Cer Eng Program ? ♦ Are recruiting materials distributed to high school students / parents ? ♦ Was the process used to recruit students effectively administered ? ♦ Are minority students in Cer Eng ?	♦ Average gpa / ACT/ SAT score of incoming students ♦ Number of ""Interest Surveys" completed during University Day and Parent's Day. ♦ Performance of undergraduates in Ceramic Eng. compared to other disciplines ♦ "Hits" on the Ceramic Engineering home page ♦ Cer Eng brochures, posters, and application forms ♦ Number/percentage of minority students
3. Ensuring that graduates have adequate oral & written communication skills.	♦ Did the students participate in the Writing Across the Curricula (WAC) program ? ♦ Do standards exist for laboratory reports ? ♦ Do the lab courses require students to give oral presentation of results ? ♦ Was the Senior Design Lab "Ted Planje" Contest successful ? ♦ Did an undergraduate participate in the Student Speaking Contest at the ACS Convention ?	♦ High quality written and oral lab reports. ♦ Quality of the Senior Design oral and poster presentations, and Ted Planje Contest ♦ ACS Student Speaking Contest results
4. Ensuring that students are well-versed in safe, laboratory practice.	♦ Did the undergraduates take Chem 04 "Lab Safety," attend the Ceramic Eng Lab Safety Lecture, and pass the Lab Safety /Exam?	♦ Passing Chem 04 ♦ Passing the Cer. Eng. Lab Safety Exam ♦ No accidents in the labs

Objectives, Evaluation Questions and Measures of the Ceramic Engineering Program

Program Objectives	Evaluation Questions	Evaluation Measures / Outcomes
5. Ensuring that students are placed on graduation.	♦ Did the graduating seniors have job offers ? ♦ Do faculty help the students "network" ? ♦ Is the job opportunities board continuously updated ? ♦ Are undergraduates exposed to industrial research ? ♦ Did the students attend the ACS convention ? ♦ Are students aware of UMR's placement service ? ♦ Did the students believe they were given adequate support in their pursuit of job positions ?	♦ Job placement results ♦ Maintained job opportunities board ♦ Number of undergraduate research assistants ♦ # of students who attended the ACS convention ♦ Data from alumni, particularly during the 3-5 year time frame.
6. Maintaining a dynamic & fun learning environment, with active student groups and open communication lines between faculty and students.	♦ Are students participating in the Student Branch of the American Ceramic Society ? ♦ Are students participating in Keramos ? ♦ Do faculty throw parties for the students ?	♦ # students in the ACS Student Branch ♦ # students in Keramos ♦ High student morale ♦ Social events
7. High quality, modern lab facilities	♦ How many ft^2 of lab space are there ? ♦ Is the equipment modern ? ♦ Does an equipment maintenance plan exist ?	♦ Documentation of lab equipment ♦ Undergraduate lab space ♦ Equipment maintenance plan
8. Maintaining an outreach program for K-12.	♦ Do students & faculty participate in K-12 activities ?	♦ Outreach kit assembled ♦ Follow up interviews with K-12 teachers, and leaders from the girl/boy scout groups etc.
9. Coordinating activities with the Minority Engineering Program to ensure that efforts related to retention of the minority students are being administered	♦ Are the minority students satisfied with the Cer Eng Program, and the efforts of the MEP to meet any special needs ? ♦ Is the atmosphere at UMR to their liking ?	♦ Documentation from interviews used as the starting point to implement changes which are deemed necessary
10. Undergraduate scholarships & development funds scholarships ?	♦ How much funding is available each year for	♦ Number and amount of undergraduate scholarships

SCHOOL of MINES and METALLURGY
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February 10, 1999

MEMO TO: Jerry Bayless, Assoc. Dean
School of Engineering

FROM: John Rockaway, Chairman
Geological and Petroleum Engineering

RE: Educational Objectives and Outcome Measures

Objective

An objective of the Geological Engineering Program is to maintain a strong commitment to teaching excellence, ABET accreditation and maintaining its preeminence as a leader in the discipline. The program has been nationally recognized by the Gourman report as one of the best in the nation and the professional success and responsibilities assumed by our alumni illustrate the significant contributions to the health, safety and welfare they make not only to the citizens of Missouri but to the nation as well.

Measurement Procedures

The measurement of the program's success in achieving this objective is accomplished through comparison with nationally established criteria and standards. These include the ABET evaluation; relative performance of graduating students in the Fundamentals of Engineering Exam and the Principles and Practice of Geology Exam; ranking in the Gourman Report; and relative statistical data provided in the annual Society of Mining Engineers Guide to Minerals Schools.

Objective

To provide our graduates with the ability to apply the principles of geology to the solution of problems in engineering practice.

Measurement Procedures

The measurement of the program's success in achieving this objective is accomplished by insuring that the geological engineering curriculum meets the guidelines for Geological Engineering programs established by ABET; by modifying the curriculum to keep the course content applicable

to the needs of the profession as identified by our Advising Board; from the results of our Alumni Assessment Questionnaire sent to our alumni one year after graduation; and, from discussions with industry recruiters and representatives. In addition, the program now requires all graduating seniors to compile a portfolio documenting their progress as a student toward achieving the attributes that ABET recommends should be developed in an engineering curriculum. Accompanying the portfolio is a report, using the items selected in the portfolio as evidence, which describes how they as students in the geological engineering curriculum, have achieved these attributes. Perhaps the most effective means of assessing program success in achieving the objective however is the feedback. In addition, a very effective measure of assessing program success in achieving of this objective is the feedback obtained from graduating students regarding their job searches, employment interviews and graduate school admissions. This is a major topic of the open discussion session held during the assessment session held with graduating seniors each semester.

Objective

To provide our graduates with the ability to effectively practice the profession of geological engineering by ensuring that they understand the concepts and responsibilities of the multi-disciplinary approach to problem solving, that they have the skills required for the writing of technical reports and that they have experience in public speaking and presentation of ideas in open public forums

Measurement Procedures

The measurement of the program's success in accomplishing this objective is achieved by requiring classes in the curriculum that teach these topics; by insuring that the principles of these objectives are included in the course work taught by program faculty; and by requiring that the understanding and practice of these concepts is integrated into student course work and is evaluated as a significant component of the grading process. Additional information for this evaluation also is provided through the assessment the program carries out with its alumni.

Objective

To ensure that our graduates are well versed in the concepts of professional and ethical responsibility; that they have a thorough knowledge of contemporary issues and an awareness of the impact of engineering solutions on both our natural environment and on society; and that they fully appreciate their responsibility to integrate these principles into their professional practice

Measurement Procedures

The measurement of the program's success in accomplishing these objectives is achieved by ensuring that discussion of these topics is included within the course work required throughout the curriculum. For example, these concepts are emphasized in the sophomore level introductory course (GeE 110) and the Senior Design Course (GeE 350) taught by program faculty and in the senior seminar course (GeE 310) that is in a large part presented by practitioners from industry. The guest speakers for this seminar are selected based on their professional accomplishments and experience and are encouraged to present their seminars on topics that stress professional and ethical responsibility.

lg

cc Dean Saperstein

Objectives, Means of Measurement, and Time-Table

Department of Geology and Geophysics

UNDERGRADUATE STUDENTS

That our graduates (undergraduate students) have:

1. a knowledge of and an ability to apply knowledge of mathematics and science.

Means of measurement:

a. GRE exam- senior year
b. Summer geology field camp examination - end of junior year
c. Involvement in undergraduate research - OURE, 390, etc.
d. Percent of graduate students supported by research and scholarship funding

2. the broad education necessary to understand the impact of scientific solutions in a global and societal context.

Means of measurement:

a. Summer geology field camp examination - junior year
b. Exit interviews - late in senior year

3. an awareness of industrial and academic opportunities in their chosen profession.

Means of measurement:

a. Departmental questionnaire - beginning of second semester of junior and senior years
b. Exit interviews – new assessment tool prepared, "Career Objectives and Awareness" – late in senior year

4. an ability to communicate effectively.

Means of measurement:

a. Seminar presentation (senior year) and class presentations (junior and senior years)
b. GRE exam- senior year

5. opportunity to experience undergraduate research with a faculty member during at least one semester of their undergraduate career

Means of measurement:

a. Number of students involved in undergraduate research
b. Number of undergraduate research credit hours

GRADUATE STUDENTS

That our graduates (graduate students, M.S. and Ph.D.) have:

1. an ability to conduct research leading to the discovery of new scientific knowledge and to communicate that knowledge to the professional community

Means of measurement:

a. Oral presentations at professional meetings - compiled and recorded in faculty resumes
b. Publications in scholarly journals and other outlets - compiled and recorded in faculty resumes
c. Oral presentations at departmental seminars - recorded in departmental files
d. Twice a semester one-page reports on progress on dissertation and thesis research - reviewed by student's faculty committee with feed-back to student from advisor

2. an advanced state of knowledge in geology and geophysics

Means of measurement:

a. Placement in academia and industry - compiled and recorded in departmental faculty meeting minutes
b. Oral presentations at professional meetings and publications in scholarly journals - compiled and recorded in departmental faculty resumes and departmental files

3. an ability to apply knowledge & skills learned in lectures and laboratories to actual field environment

Means of measurement:

a. Successful completion of a thesis or dissertation - filed in UMR library and department
b. Research experience or industrial employment during summer session

9. Changed Geology 52 from a 3-hour to a 4-hour course to incorporate new material from advances in the field of Evolution of the Earth.
Change due to results from student input on Exit Interviews.

10. Changed Geophysics 382 from applications to mining and engineering to applications to environmental and engineering to reflect areas of growing job opportunities for departmental graduates.
Change due to results from student input on Exit Interviews.

11. Increased the number of students involved in undergraduate research connected with faculty research projects.
Change due to results on GRE and Exit Interviews.

12. Initiated monthly one-page progress reports by graduate students on their dissertation and thesis research in order to provide departmental faculty with another means to more closely assess their progress.
Two graduate students were dropped from our department's program last fall due to inadequate progress.

In addition, the following curriculum changes have been submitted to the UMR curriculum committee for approval.

13. New emphasis area in Petroleum Geology

14. Change name of emphasis area to Groundwater and Environmental Geology

15. Make 7 changes in required courses in the four existing emphasis areas in the Department of Geology and Geophysics.

SPECIFIC EXAMPLES OF CHANGES MADE IN GEOLOGY AND GEOPHYSICS TROUGH THE UTILIZATION OF ASSESSMENT RESULTS

1. Changed the Geology 373 Field Camp requirement from a single 6 hours requirement to two three-hour requirements to provide increased integration of the field results at Cedar City, Utah with subsequent laboratory results at UMR.
Change due to results from student input at end of Summer Field Camp

2. Initiated a procedure in which the department notifies by E-mail all students in Geology and Geophysics about job openings.
Change due to results from student input on Exit Interviews

3. Initiated oral presentations in many courses in Geology and Geophysics in order to increase student ability to communicate orally. The courses that now require oral presentations are: Geology 52, 227, 294, 301, 312, 324, 329, 338, 341, 375, 376, and Geophysics 286 and 380.
Change due to results from student presentations in seminars.

4. Initiated written term papers in many courses in Geology and Geophysics in order to increase student ability in written communication. The courses that now require written reports are: Geology 52, 227, 281, 294, 301, 312, 324, 329, 338, 340, 341, 344, 375, 376, and Geophysics 286 and 380.
Change due to results from student presentations in seminars.

5. Fundamental principles of optical mineralogy have been introduced into Mineralogy 113, Petrology 130, and Petrology and Petrography 234. The change was in recognition of the fact that some of the content of the former course (211) is superceded by newer microbeam techniques. Optical Mineralogy 211 is now available as an elective.
Change due to results from student input on Exit Interviews and results on GRE examinations.

6. Changed Statistics 215 Geology and Geophysics curriculum requirement to allow choice of Statistics 213, 215, 217, or Geological Engineering 315.
Change due to results from student input on Exit Interviews.

7. Changed Mineralogy 114 to an elective to allow the presentation of data and techniques on more advanced aspects of mineralogy.
Change due to results from student input on Exit Interviews and results on GRE examinations.

8. Changed Petrology 130 from a 3-hour to a 4-hour course to allow the presentation of the principles of Optical Mineralogy and Petrography to be incorporated into the 130 course.
Change due to results from student input on Exit Interviews.

Metallurgical Engineering - Outcomes Assessment

February, 1999

Mission and Academic Goals

The University of Missouri-Rolla has as its mission the education and training of tomorrow's leaders in engineering and science, and the department's objectives are fundamental to those of the campus Over the period of 120 years the department has been an integral part of the educational process in Rolla, and has produced over 2200 graduates who have contributed in no small way to the development of the state, the mid-west, and the nation

The mission of the department is to provide a quality, comprehensive undergraduate and graduate education in the traditional areas of metallurgical engineering. The major program goals are

1 to produce a Bachelor of Science graduate with:
   a) a sound fundamental knowledge of basic science and engineering topics together with an understanding of the application of fundamentals to a broad range of metallurgical engineering topics
   b) extensive hands-on experience with regard to laboratory, computer, communication, and leadership skills, to enable contributions to be made in any technical area associated with metallurgy.
   c) the ability to continue life-long learning, to understand global, ethical, and social issues, and to work in a safe and environmentally responsible manner
   d) excellent career opportunities as a result of their education and the reputation of the degree program with industry and other academic institutions

2 to maintain a strong graduate program, which ensures
   a) the provision of graduate engineers who have advanced knowledge, research experience in areas pertinent to metallurgical industry, and good career opportunities
   b) significant scholarly activity including funded research
   c) an active and involved faculty
   d) a robust, healthy environment for education at all levels

3 to provide an educational environment conducive to learning

4 to provide service courses for students in other engineering disciplines in the areas of materials and manufacturing, and to ensure that the courses are at the level desired and have appropriate content

5 to interact with professional societies and industry to promote continuing education, research, and technical information transfer; and to enable departmental resources to be utilized to assist the state agencies and industry of Missouri and the mid-west

To achieve these goals it is necessary that the department have appropriate funding and resources, a talented, dedicated faculty and staff, and a freshmen class with an adequate academic background and a desire to learn. To control the educational process, the department undertakes significant student, faculty, and resource assessment Student academic outcomes are major measured variables in the education process, but faculty, staff, and resources represent major departmental controls on outcomes, and hence must also be assessed

Throughout its history, the metallurgical engineering degree from the campus at Rolla has been well received and recognized throughout the metals industry as a sound, well balanced, practical qualification The emphasis on graduating engineers focused on industrial practices is highly appropriate for the State of Missouri and for the contiguous states, which are major manufacturing centers of the U S Missouri has a large metal mining industry, significant aerospace and chemical industries, and considerable metal manufacturing capabilities. Thus the future economic well-being of the region is dependant upon a supply of engineers capable of sustaining and developing technology

Overall Assessment Activities

The department is committed to collecting meaningful data relating to the ability of the department to meet its goals and to continuously improve its performance To this end the department seeks data from a variety of external, campus, and departmental sources relating to undergraduate and graduate students, faculty, staff, and resources, and specific data sources are given below (● students, ■ faculty, ◊ staff, ▲ resources)

a) campus and external data - a variety of campus assessment data, and additional external data, are received by the department, and such data include

● Freshmen surveys - received from the Assessment Office
● APT scores - received from the Assessment Office.
● grades from basic sciences, engineering science, humanities and social sciences, and communications
● EIT scores received from Dr Paul Monger, NCEES
● Placement data from the Career Opportunities Center
●■▲ Discipline specific data received from TMS (Professional Society)
●■ Alumni surveys received from Alumni Office
●■ Industry surveys received from Alumni Office
■ Departmental, school and campus Teaching Evaluation scores received from the Committee for Effective Teaching
■Teaching hours received from Institutional Research
■Research funding and publications received from Institutional Planning
▲ Funding and equipment information from the Office of Institutional Research and Planning.

b) department data - the department also collects additional data which include

● grades on departmental lecture and laboratory courses
● senior assessment/graduate admission through a 60 question exam covering the basic requirements of the degree course.
● capstone design report and presentation
● exit interview of graduating seniors each semester
● exit survey of graduating seniors each semester
● placement data for all students
■ periodic advising surveys through the extra questions on the teaching effectiveness questionnaire
ˆ periodic administrative surveys through the extra questions on the teaching effectiveness questionnaire
●student assessment of course content and teacher performance through interviews with the chair each semester.
●course evaluation by students each semester with instructor
■ course evaluation by faculty each semester with chair
●■ degree evaluation and career progression through surveys, faculty contacts, and MetAlum Newsletter

Analysis and Feedback

1 Student Academic Outcomes

Once student data have been collected, it is circulated to faculty and discussed in meetings to determine appropriate actions to enhance the department's ability to meet its academic goals Such actions are documented and the outcomes reviewed periodically Campus, external and departmental data are used by the faculty at various times in the educational sequence to

- recognize and analyze the abilities and attitudes of its students to permit appropriate actions to be taken with regard to teaching and advising (Goal 1a, 1b, 1c, 1d, 2a, 2d, 3)
- analyze student performance on the APT and provide direction and advice to students with identified deficiencies. (Goals 1a, 1b)
- analyze the student performance on the various topics of the EIT to identify weaknesses and strengths The analysis leads to consideration of actions, where appropriate, to correct perceived problems In the past, courses have been modified to ensure that students have appropriate instruction in engineering economics and statistics. (Goal 1a, 2a)
- analyze the placement of graduates with respect to industry, duties, remuneration, and location (Goal 1d, 2a)
- analyze the satisfaction of students, alumni and industry with the metallurgical engineering program Actions resulting from such analysis have been used to add, delete and modify courses in the curriculum, to modify scholarship allocations, to focus fund raising activities, to develop social activities, to enhance seminar activities, to enhance field trips and

conference visits, to enhance coop and summer job programs, and to identify research areas (Goals 1a, 1b, 1c, 1d, 2a, 2d, 3, 5)

- interact with other departments to review impact of service courses (Goal 4)

Specific examples -

Creation of freshmen activities and meetings to integrate freshmen into the Department even though they are primarily in the Freshmen Engineering Program
Addition of introductory metallurgy course to Semester 2 following discussions with Advisory Board, alumni, and students
Replacement of required advanced chemistry courses with advanced science elective course following discussions with Advisory Board, alumni, and students
Replacement of electrical circuits course with additional technical electives following discussions with Advisory Board, alumni, and students
Addition of engineering economics material to senior design course in response to poor student performance on EIT in an area faculty considered important To date, student performance in this area is significantly improved
Addition of required statistics course in response to industry and alumni input
Based on APT results, students are advised to attend appropriate campus support activities and to request additional assistance from faculty in areas of weakness A typical example is were a student has a low writing proficiency, the advisor recommends that the student take writing work to the Writing Center for assistance, and the advisor also requests additional assistance for the student from faculty teaching courses where writing is an important component Progress is then monitored as student progresses through the curriculum

2 Faculty and Staff

The performance of the faculty and staff are major controlling variables in the educational process, and to enhance the department's ability to meet its goals, the feedback control must also be directed to faculty and staff External, campus, and departmental data are used by the chair to

- assess faculty performance in teaching, in conjunction with campus teaching evaluation data, and advising Faculty receive input from individual classes and where appropriate modify course content and instruction for the next semester presentation Faculty provide reports of assessment and action to chair each semester Information received from student interviews and surveys by the chair is collated, analyze and fed back to faculty Where necessary, corrective actions are discussed, and appropriate actions implemented (Goals 1a, 1b, 1 c, 1 d, 2a)

- assess faculty performance in research based on publication and research activities comparison with peer groups from on-campus and off-campus Problem areas are identified and semester load adjusted to provide incentives and assistance to enhance performance (Goals 2b, 2c, 2d)

- assess faculty activities in service areas such as continuing education, professional society, and state and local committees (Goal 5

- assess staff performance through surveys of faculty and students, and to determine appropriate actions (3)

- provide appropriate information for industrial advisory council meetings, which generate recommendations for departmental action (Goals 1a,1b,1c,1d, 2a, 2c, 2d, 3, 4, 5)

- provide appropriate data for student recruitment i e. job placement, salaries, graduation rates, etc (Goals 1d, 2a, 2d)

Specific examples -

Faculty with below average teaching assessments have been given the opportunity to attend seminars and short courses aimed at enhancing teaching. There is some evidence of significant improvements resulting from such activities

Faculty have been given teaching load reductions to facilitate enhanced research activities deemed appropriate to seek tenure and/or promotion.

In MET 126, the BASIC programming language has been replaced with Visual Basic as a result of student and industry input.

Student perceptions of staff strengths (friendliness, knowledge, availability) and weaknesses (none !) have been communicated to staff, and actions to enhance the service (e-mail listings for distribution of information) initiated.

Student concerns (report format, waiting time) with laboratory activities have been communicated to faculty and modifications (varied report formats, multiple lab activities) introduced to remove concerns

3 Resources

Using external and campus data, the departmental resources are reviewed and actions determined, where possible, to correct deficiencies with respect to faculty and staff, equipment (Goal 1b , classrooms (Goal 3), technical support (Goal 2b), clerical support (Goal 2b), and funding (1, 2, 3, 4, 5)

Specific examples

As a result of input from students regarding laboratory equipment and procedures, the departments has upgraded its electron microscopy facility to remove the need for time consuming and expensive photography through the use of digital image processing

To enhance classroom presentations and to satisfy student demands for improved audio visual instruction, the department spearheaded the purchase and commissioning of computer based multi-media systems.

To meet the faculty and industry perceived need for instruction and research in the areas of thin

metallic films and mechanical and thermal processing, the department has aggressively sought funding for new faculty positions, and is currently preparing to advertize for such faculty through State Enhancement funding

Faculty Involvement

Faculty play a significant role in determining the assessment process, and in analyzing data, determining appropriate actions, and assessing outcomes Every faculty member has input into the planning of assessment instruments such as surveys and questionnaires, and all data resulting from such instruments are discussed in faculty meetings. Faculty obviously have responsibility for actions that they take for their own courses based on peer review, student teaching evaluations and comments, their own course evaluation and action reports, and chair course review with students In addition, faculty review senior assessment data, EIT data, senior questionnaires, alumni surveys, advisory board input and industry input

Student Involvement

As metallurgical engineering is a relatively small department, it is possible to disseminate information through class interaction, through advisors, and through faculty/student personal interaction Thus no formal structure is currently in place to provide students with assessment information and to receive student input on assessment, but informally faculty ensure that students, especially seniors, are aware of such activities

Summary

It can be clearly seen that the acquisition and analysis of assessment data permit appropriate actions to be determined to provide control of the educational process In turn such assessment and analysis procedures facilitate program enhancement Overall, assessment activities have a significant impact on the operation of the department, and have, and continue to, assist in shaping the departmental goals, philosophy, and operating procedures

Academic Outcome Assessment Plan

Department of Mining Engineering
University of Missouri - Rolla
April 1998

This plan articulates the goals and objectives for the Department of Mining Engineering and methods to which mining graduates are measured as to how these goals are met, and how are these assessments used for future curriculum improvement This plan is intended to serve as a basis for both the 1999 North Central Association visit and the 2003 ABET visit

Mission Statement and Report Purpose:

The overall objectives of the Department of Mining Engineering are to provide the student with a specialized expertise in mining engineering, a cultural foundation and a sound basis for future growth and development These objectives are achieved at the undergraduate level by providing education in basic sciences, engineering sciences and design, and in the field of humanities and social sciences

In keeping with the departmental mission, and in response to the North Central Association's accreditation activities, the Mining Engineering Department has prepared this report on the planned assessment activities The report first presents the expected learning outcomes (the knowledge, skills, behaviors, and attitudes) and the assessment tools which will be used for measuring program success, followed with a discussion on faculty and student involvement in the assessment process, and concludes with a timetable for the assessment project

The Department's faculty stays very much abreast of the mining industry activities and technology, not only within the State, but worldwide, and they are thereby in a position to not only train our students in the latest mining technology and for leadership roles in industry, but to bring that technology to the operating mining properties within the State through frequent contacts with these operators Many times the research that is being performed has to be demonstrated in an operating environment, and the local operations allow this to take place and share in the benefits Thus, the mission and the activities of the Department blend with the mission and vision of the University

Since the success of students will be the ultimate measure of success, the Department of Mining Engineering is committed to ensuring that learning goals, the tools with which to measure achievement, and any curricular changes made will be consistent with UMR mission and vision and both satisfy NCA and ABET requirements

Learning Goals and Assessment Tools:

The Mining Department offers B S , M S , and Ph D in mining engineering Goals described below are intended to apply to all three degreed programs, assessment tools specific to graduate degree levels are indicated where appropriate Measurement tools are currently in place unless noted as "proposed" or "under revision "

The undergraduate programs are accredited by the Engineering Accreditation Commission of Accreditation Board for Engineering and Technology (ABET) and the North Central Association of Colleges and Schools

Goal# 1 Students should master mining engineering fundamentals necessary to function as a professional in an appropriate-level engineering position

Tools
1. Department requires all mining engineering students take FE examination before graduation
2. Evaluation of technical knowledge demonstrated in the required senior capstone design course MinE-393 Mine Planning Design
3. Information gathered via interview/survey of existing seniors, targeted specifically to this outcome
4. Performance in required comprehensive exams (M S and Ph D).
5. Unscheduled surveys with alumni regarding student performance for both summer and permanent
6. Department requires that all mining engineering students have summer jobs and/or co-op experience before graduation Interview with students who just completed summer intern or summer experience and with supervisors who supervise students about their job performance

Goal# 2 Students should master, or have the ability to acquire, the following skills necessary to tackle new problems and/or technologies, including critical thinking, resourcefulness, problem-solving and research skills

Tools
1. Evaluation of solutions to open-ended problems on homework and exams in current courses
2. Evaluations of innovation, research, and problem-solving skills demonstrated in required mining engineering capstone design course.
3. Information gathered via annual survey of alumni two, five, and ten years after graduation, questions targeted specifically on learning outcome
4. Number of external publications and presentations (M S and Ph D. students)
5. Evaluation of research proposals (Ph D. students)

Goal# 3 Students should be able to communicate effectively their technical/professional material in written, oral, visual, and graphical forms

Tools
1. Evaluation of portfolio of written materials from writing-emphasis, writing-intensive, and capstone design courses, and courses with laboratory sessions
2. Evaluation of oral presentations in above courses
3. Information gathered via annual survey of alumni two, five, and ten years after graduation, questions targeted specifically on learning outcome
4. Evaluation of thesis and/or dissertation (M S and Ph D students)
5. Evaluation of graduate student seminar presentation and oral exams (M S and Ph D students)

Goal# 4 Students should be aware of engineering ethics, their social responsibility, and the impacts on society of mining engineering

Tools
1. Evaluation of courses covering ethical, global, environmental, safety and diversity issues (MinE-270, MinE-322, MinE-376, and MinE-393)
2. Test given in required mining engineering safety courses (MinE-151 and MinE-202)
3. Test given in other required mining engineering courses with labs of which safety is an integral part
4. Information gathered via annual survey of alumni two, five, and ten years after graduation, questions targeted specifically on learning outcome

The Department of Mining Engineering recognizes that, although difficult, it is important to obtain quantifiable, objective data from surveys, and intends to use such data to supplement curriculum reviews, and changes, if necessary A comprehensive and well-planned survey can provide important supplemental data on student knowledge and performance in all areas addressed.

With an increasingly global and diverse nature of the mining industry, and the increased societal demand of mining safety, the Department is committed to this goal.

Although this plan is developed by the mining engineering faculty, students will be asked to review the plan and provide comments and suggestions on the regular basis (for example, annually) or more often as needed since they are the end-users of this assessment activities Information and results gathered from student, alumni, and employer surveys and from student interviews will be compiled, shared, and discussed with department faculty and, as appropriate, with students It is also proposed the departmental web page be used as a vehicle for the purpose so students, faculty, and staff can learn of and discuss information gathered as part of the assessment process.

Timetable for Implementing Assessment Program:

While most of the items mentioned above have been in place for a long time and conducted irregularly, it is proposed that they are conducted on the regular basis and some of the proposed actions will take effect in the next three years

Academic Year 1998-1999

Although student writing and oral communication skills have been emphasized in many courses (for example, MinE-322 and MinE-376, and courses with lab sessions), they are implemented by the individual instructors only and only in appropriate courses It is proposed that these activities be conducted uniformly across the entire curriculum in the Department. Uniform criterion needs to be developed to measure goal achievement in the various areas above, and will devise a method for objective rating by faculty/staff and students

The curriculum representative, with faculty input and support, will identify opportunities and methods for assessment in current courses, e.g., problems requiring creativity, problem-solving, and/or communications skills, special assessment criteria for mining engineering problem and reports in capstone course, etc

The graduate representative, with input from the faculty, will determine criteria to be used in assessing performance in graduate seminars, presentations, thesis, and dissertations.

One full faculty meeting will be devoted to evaluating assessment goals, tools, and results

Academic Year 1999-2000

The curriculum representative, with input from faculty, staff, student, and Development Board, will modify the alumni survey for use in an employment survey The two, five, and ten year survey will commence with results circulated to faculty, and where appropriate, students.

The curriculum representative will analyze and circulate results from the various assessment activities to faculty, students, alumni, and employers (as appropriate), and solicit suggestions for curriculum revisions

One full faculty meeting will be devoted to evaluating assessment goals, tools, and results

Academic Year 2000-2001

Alumni survey will continue

The Department will meet to discuss and evaluate the assessment program the goals and measurement tools, the findings, the changes proposed and in place as a result of the program, and any modifications needed to ensure continued validity and usefulness

Mission Implementation into the Next Millennium:

The Department of Mining Engineering at UMR is positioned to continue its competitive edge as one of the leading learning and research centers for the mining industry well into the next millennium This Department is recognized by both the mining industry and peer mining schools as one of the strongest programs in the country, and is committed to continue its efforts to educate quality students for the mining industry, both domestic and international

Nuclear Engineering - Outcomes Assessment
Fall, 1998

Mission and Academic Goals

The University of Missouri-Rolla has as its mission the education and training of tomorrow's leaders in engineering and science, and the department's objectives are consistent with those of the campus.

The mission of the Nuclear Engineering department is to provide a quality, comprehensive undergraduate and graduate education in the major areas of nuclear engineering. Electric utilities in Missouri and its neighboring states own and operate nuclear power plants that need a constant supply of nuclear engineers.

Since its inception, the nuclear engineering degree from UMR has been well received and recognized throughout the nuclear industry as providing a sound, well balanced, and practical education. The nuclear industry, national laboratories, and government agencies seek and employ our graduates.

The major program goals are:

1. to produce a Bachelor of Science graduate with:
   a) a sound fundamental knowledge of basic science and engineering topics together with an understanding of the application of fundamentals to a broad range of nuclear engineering topics.
   b) extensive hands-on experience with regard to laboratory, computer, communication, and leadership skills, to enable contributions to be made in all technical areas associated with nuclear engineering.
   c) the ability to continue life-long learning, to understand global, ethical, and social issues, and to work in a safe and environmentally responsible manner.
   d) excellent career opportunities resulting from their education with the reputation of the degree program in the industry and with other academic institutions.

2. to maintain a strong graduate program, which ensures:
   a) the provision of graduate engineers who have advanced knowledge and research experience in areas pertinent to the nuclear industry, along with good career opportunities
   b) significant scholarly activity including funded research
   c) an active and involved faculty
   d) a healthy, active environment for education at all levels.

3. Interaction with professional societies and industry will promote continuing education, research, and technical information transfer; and will enable departmental resources to be utilized to assist the state agencies, the industries of Missouri and of the nation.

The achievement of these goals necessitates the department having appropriate funding and resources, a dedicated and talented faculty and staff, and a student body with an adequate academic background and a desire to learn. To evaluate the educational process, the department undertakes significant assessment steps that measure outcomes. Since faculty, staff, and resources have a major impact on the outcomes, they are also assessed.

Overall Assessment Activities

The department is committed to collecting meaningful data relating to its ability in meeting its goals, and to continuously improving its performance. To this end, the department seeks data from a variety of external, campus, and departmental sources relating to under-graduate and graduate students, faculty, staff, and resources. The specific data sources are given below:

a) campus and external data - a variety of campus assessment data, and additional external data, are received by the department; such data include

i. Freshmen surveys - received from the Assessment Office.
ii. APT scores - received from the Assessment Office.
iii. grades from basic sciences, engineering science, humanities and social sciences, and communications.

iv. EIT scores received from Dr. Paul Munger, NCEES.
v. Placement data from the Career Opportunities Center
vi. Alumni surveys conducted by the department and the Alumni Office.
vii. Industry surveys received from Alumni Office.
vii. Departmental, school and campus Teaching Evaluation scores received from the Committee for Effective Teaching.
ix. Teaching hours; received from Institutional Research.
x. Research funding and publications; received from Institutional Planning.
xi. Funding and equipment information; from the Office of Institutional Research and Planning.

b) department data - the department also collects additional data which include:

i. grades on departmental lecture and laboratory courses
ii. capstone design report and presentation
iii. exit interview of graduating seniors each semester.
iv. exit survey of graduating seniors each semester.
v. placement data for all graduates.
vi. student assessment of course content and teacher performance through interviews with the chair each semester.
vii. degree evaluation and career progression through surveys, faculty contacts, and department newsletter.
viii. Nuclear Engineering Development Board.

Analysis and Feedback

1. Student Academic Outcomes

Once student data have been collected, it is circulated to faculty and discussed in meetings to determine appropriate actions to enhance the department's ability to meet its academic goals. Such actions are documented and the outcomes reviewed periodically. Campus, external and departmental data are used by the faculty at various times in the educational sequence to:

- recognize and analyze the abilities and attitudes of its students to permit appropriate actions to be taken with regard to teaching and advising.
- analyze student performance on the APT and provide direction and advice to students with identified deficiencies.
- analyze the student performance on the various topics of the
- EIT to identify weaknesses and strengths. The analysis leads to consideration of actions, where appropriate, to correct perceived problems. In the past, courses have been modified to ensure that students have appropriate instruction in engineering economics and statistics.
- analyze the placement of graduates with respect to industry, duties, remuneration, and location.
- analyze the satisfaction of students, alumni and industry with the nuclear engineering program. Actions resulting from such analysis have been used to add, delete and modify courses in the curriculum, to modify scholarship allocations, to focus fund raising activities, to develop social activities, to enhance seminar activities, to enhance field trips and conference visits, to enhance coop and summer job programs, and to identify research areas.

Specific examples -

Teaching of Nuclear Technology Application course to freshmen.

Creation of freshmen activities and meetings to integrate freshmen into the Department even though they are primarily in the Freshmen Engineering Program.

Replacement of electrical circuits course with a more comprehensive electrical engineering course following discussions with Advisory Board, alumni, and students.

Based on APT results, students are advised to attend appropriate campus support activities and to request additional assistance from faculty in areas of weakness.

Request for assistance from the Writing Center to help students with writing deficiencies.

2. Faculty and Staff

The performance of the faculty and staff are major factors affecting the educational process, and to enhance the department's ability to meet its goals, the feedback control must also be directed to faculty.

External, campus, and departmental data are used by the chair to:

- assess faculty performance in teaching. Faculty receive input from individual classes and where appropriate; modify course content and instruction for the next semester presentation. Information received from student interviews, and surveys by the chair is collated, analyzed and given to faculty. Where necessary, corrective actions are discussed, and appropriate actions implemented.

- assess faculty performance in research based on publication and research activities comparison with peer groups from on-campus and off-campus. Problem areas are identified and semester load adjusted to provide incentives and assistance to enhance performance.
- provide appropriate information for industrial advisory council meetings, which generate recommendations for departmental action.

- provide appropriate data for student recruitment i.e. job placement, salaries, graduation rates, etc.

Specific examples -

Faculty with below average teaching assessments have the opportunity to attend seminars and short courses aimed at enhancing teaching. There is some evidence of significant improvements resulting from such activities.

Faculty are given teaching load reductions to facilitate enhanced research activities deemed appropriate to seek tenure and/or promotion.

3. Resources

Using external and campus data, the departmental resources are reviewed and actions determined, where possible, to correct deficiencies with respect to faculty and staff, equipment, classrooms, technical support, clerical support, and funding.

Specific examples -

The Computer learning center is continually upgraded with top-of-the-line personal computers. During the last five years, computing equipment has been added or upgraded at an approximate total cost of $100,000.

Input from students regarding laboratory equipment, resulted in the department's upgrade of its radiation measurement laboratory. In the last five years, the radiation measurements laboratory has been equipped with state-of-the-art equipment costing about $75,000.

To enhance classroom presentations and to satisfy student demands for improved audio-visual instruction, the department acquired a computer-based multi-media system.

Faculty Involvement

The nuclear engineering faculty plays a pivotal role in the assessment process, including the establishment of procedures, analysis of assessment outcomes, and the determination of appropriate actions to rectify any weakness in our program. Assessment instruments such as surveys and questionnaires are planned and discussed in faculty meetings. Faculty also review senior assessment data, senior questionnaires, graduate senior interview information, advisory board and industry input.

Student Involvement

Because of the small size of the nuclear engineering department, it is possible to disseminate assessment information to our students and receive their feedback through student/faculty interactions in classes, as well as during advising. Formally, during a seminar hour every

winter semester, students and faculty get together for an information exchange meeting. Assessment information is passed on to the students by the department chair at this meeting, and the students' input to the assessment process is obtained.

Summary

The analysis of assessment data has helped the nuclear engineering department in identifying strengths and weaknesses, in modifying the curriculum, and in redirecting human and financial resources to meet the needs of our students, faculty, and the nuclear industry.

PETROLEUM ENGINEERING PROGRAM
EDUCATIONAL OBJECTIVES AND MEANS OF ASSESSMENT

PROGRAM OBJECTIVES

The Petroleum Engineering program has developed a series of program objectives under the following general guidelines

- They are in agreement with the stated objectives of the University of Missouri-Rolla to provide a quality undergraduate experience and to promote graduate studies
- They are based on consultations with our various constituents, such as energy companies, professional organizations, alumni, faculty and students

In view of these, the primary objectives of the Petroleum Engineering program are

(1) To train our students to master Petroleum Engineering fundamentals

(2) To train our students to know how to apply these fundamentals to formulate and solve the problems of oil and gas drilling, production, resource management and conservation.

(3) To maintain a quality undergraduate program where our graduates have fundamental working knowledge of general engineering, mathematics and the sciences.

(4) To give the students exposure to Engineering Ethics as well as to the Humanities and Social Sciences thereby helping to improve their oral and written communication skills

(5) To promote a small, high quality graduate program

(6) To continually assess the effectiveness of the program

The undergraduate program is designed to provide a well-rounded, technically strong curriculum that prepares students for a successful professional career, while the graduate program prepares students for advanced work in Petroleum Engineering or other related professional areas

The next section presents the modes of assessment and when and how the data are collected and analyzed to ensure that the tools used and the outcomes meet our stated goals

Assessment of Program Objectives

Our success in meeting the objectives of the Petroleum Engineering program is measured through a number of procedures These procedures are diverse in their approach and provide for a comprehensive analysis of the extent to which the objectives have been met These procedures are collectively termed "Assessment tools"

Baseline data: All UMR students enter into their respective disciplines at the sophomore level At this level then, the Academic Profile Test (APT) is administered and the results used to measure broad based skill level in general education at entry into Petroleum Engineering

Specific to the Petroleum Engineering curriculum however, pre-testing to obtain baseline data is unnecessary because entering students know practically nothing about the contents of the subject matters Thus, any knowledge gained through the assessment tools detailed below is "value added" knowledge

Listed below are the component parts of our assessment program with specifications on how and when data are to be collected, analyzed, interpreted, and utilized Finally, we detail the process for remedial action when and where the stated objectives are not met

These procedures include the following components

Objective # 1: To train our students to master Petroleum Engineering fundamentals.

Assessment tools

Homework assignments (individual and group)
Tests and/or quizzes (including mid-term and final exams)
Fundamentals of Engineering (FE) Examination
Term projects and Papers

When and how In general, homework assignments are given weekly The student solutions are collected the following week, graded by the instructor or a graduate assistant and returned to the students. All assignments are usually weighted equally. Quizzes and Tests are given typically once a month. They are also graded and given a weighting factor. The final grade is a weighted average of all the composite factors.

All graduating seniors are required to take the FE examination. Performance in the FE examination as compared with national norms is utilized as one of our indicators

Objective # 2: To train our students to know how to apply these fundamentals to formulate and solve the problems of oil and gas drilling, production, resource management and conservation

Assessment tool

Petroleum Engineering capstone design course (PE 347)
Participation and performance in Undergraduate Research Experience (OURE) projects (participation is selective due to limited resources)
Comprehensive examinations (graduate students)

When and how: All seniors in Petroleum engineering are required to take the Petroleum Engineering capstone Design Course (PE 347). The course requires verbal presentations and written reports Assigned capstone design project(s) are used to assess each student's ability to utilize the knowledge gained in their Petroleum engineering courses It requires the students to analyze an oil or gas reservoir from the exploratory stages by creating and using geologic maps, reading well logs, utilizing drilling and well reports, calculating production data and determining in-place reserves.

Participation and performance in Undergraduate Research Experience (OURE) projects are also used to gauge the performance of our undergraduates Participation is selective and restricted by the available budget This tool is therefore of very limited use since it affects only a very small number of students in any given year.

For graduate students, performance in a comprehensive examination given about midway through their graduate school career represents a good assessment tool

Objective # 3: To maintain a quality undergraduate program where our graduates have fundamental working knowledge of general engineering, mathematics and the sciences.

Assessment tool

Academic Profile Test (APT)
Fundamentals of Engineering (FE) Examination

When and how: All sophomores (except transfer students) are required to take the Academic Profile Test (APT). This test provides entry-level information on the students' broad based skill level in general education. Students found to be deficient in two or more

areas will be identified and their performance checked to see if it is consistent with their overall student record If so, additional course work may be recommended for that student.

All seniors are required to take the Fundamentals of Engineering (FE) examination as part of the University-Wide Assessment Program A large percentage of domestic petroleum engineering students pass the FE exam. Once every semester, the results from this examination are collected, and analyzed. This allows the faculty to evaluate the performance of our students with respect to nationally recognized test norms

Objective # 4:) To give the students exposure to Engineering Ethics as well as to the humanities and social sciences and helping to improve their oral and written communication skills.

Assessment tool

Ethics (taught in PE 310)
Technical writing (English 160)
Public speaking (Speech and Media studies 85)
Petroleum Engineering writing Intensive courses (PE 242, PE 302, and PE 347)
Petroleum engineering senior seminar (PE 310)
Weekly essays in PE 141 class

When and how: Three classes have been designated as "writing intensive" classes They are (PE 242, PE 302, and PE 347). All these classes require a written report at the end of the semester We intend to use these classes to assess the written communication skills of the students In the Petroleum senior seminar class (PE 310), the students make oral presentations on selected scientific papers assigned from the proceedings of the most recent Petroleum Engineering Annual Technical Convention Engineering Ethics is taught in our PE 310 seminar class (the first 4 weeks) In addition to all these, writing skills are assessed in PE 141 where the students are required to submit weekly summaries of the material covered for the week. These are graded and returned to the students

Objective # 5: To promote a small, high quality graduate program.

Assessment tools

Theses and dissertations
Comprehensive examinations

When and how: Masters degree students can choose a thesis or non-thesis option For those on thesis option, and for doctoral degree candidates, an oral defense is required For Master's degree candidates on the non-thesis track as well as for all doctoral degree candidates, a comprehensive examination is required Performance in the comprehensive examinations is assessed by all the faculty and feedback given to the students on how well they performed. The students get a second chance at the examination after they remedy the deficiencies exposed by the examination

FEEDBACK.....CLOSING THE LOOP

Objective # 6: To continually assess the effectiveness of the program

Assessment tools:

Exit Interviews
Industry Advisory board recommendations

When and how: All graduating seniors are required to participate in an "exit interview" This is done once a year in a group meeting with the Head of Petroleum Engineering. The students are also encouraged to meet individually with the Head whenever they so desire The interview includes a questionnaire eliciting the students' opinions on the teaching capability and technical competence of the faculty, the effectiveness of the curriculum and adequacy of program facilities. The group discussions focus on the evaluation of the program and how well it prepared them for their summer jobs especially in comparison with their peers from other institutions

The Petroleum Engineering program maintains well-established contacts with industry The program is in the process of establishing a formal Industry Advisory Board Since many of the members will likely be employers of our graduates, we see this board as being a source of constant feedback on how well we meet our stated goals about educating our students. Conclusions drawn from the exit interview, and from the Industry Advisory board as well as from other employers of our graduates will be used to improve the capabilities and direction of the program.

IMPLEMENTATION TIMETABLE

1999: Establishment of Industry Advisory Board.
1999-2001: Continuous data collection and analysis.
Refinement of assessment methods and interpretations.